ILLUSTRATED
ELECTRICAL REVIEW
A Journal of Scientific and Electrical Progress.

VOL. 26. No. 18. WEEKLY.

NEW YORK, WEDNESDAY, MAY 1, 1895.

$3 per Annum. Single Copies, 10 Cents.

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Entered at Post Office, New York, as Mail Matter of the Second Class.

VIEWS, NEWS AND INTERVIEWS.

"I would like to see the prices of iron and copper increase from 25 to 50 per cent," said a well-known electrical salesman. "Then we could get better prices for electrical apparatus. It's astonishing how little of anything else there is in a dynamo or motor besides copper and iron."

At present Col. Ned Maltby is busy with the experiments some scientific men are carrying on with the fire-fly, says a writer in *Scribner's*. These, if they are successful, Colonel Ned is confident will reduce the cost of living, of public expenditures, and make notable changes in domestic life. Every one knows that food taken into the body after supplying nourishment is converted into heat. In the electrical eel this process is so varied that instead of heat electricity is produced. In the fire-fly, on the contrary, the result, again varied, is light. Thus it appears that these various energies —heat, light, electricity—are but different manifestations of the one cause, and consequently ought to be readily transformed the one into the other.

Now how this is to be done is what the scientific gentlemen are trying to find out. The fire-fly has, of course, a special organ for his electric light, as the eel has for his electric action. But chemists have discovered that certain fats containing sulphur and phosphorus, burned at a low temperature, will produce light. This necessary slow combustion the human body furnishes. The inference seems clear that the only thing remaining is to furnish the human with the phosphoric and sulphuretted fat in some form that can be utilized.

When this is done, says Colonel Ned, every man may be his own lantern. It is not probable, he continues, that the formula of this light-making food will be given to the public when it is discovered, but he foresees that it will be put into some easily portable form. Lozenges or pills he thinks most probable, which, if they are distasteful, can be sugar-coated. Most probably the formula will be secured by a company of scientific men and capitalists. However, the cost of the lozenges or pills will be slight, as the gentlemen admit that "nature produces this cheapest light at one-four-hundredth part of the cost of the energy expended in a candle-flame at but an insignificant fraction of the cost of the electric light, or the most economical light that has been devised."

Col. David B. Parker, general manager of the Bell Telephone Company, of Buffalo, N. Y., spent Wednesday of last week in this city. Telephone matters in Buffalo are quiet, the service giving good satisfaction and the number of subscribers increasing. Buffalo is also enjoying a boom in substantial business houses, Mr. D. H. Burnham having designed a new $3,000,000 structure, in which Kidder, Peabody & Company are interested.

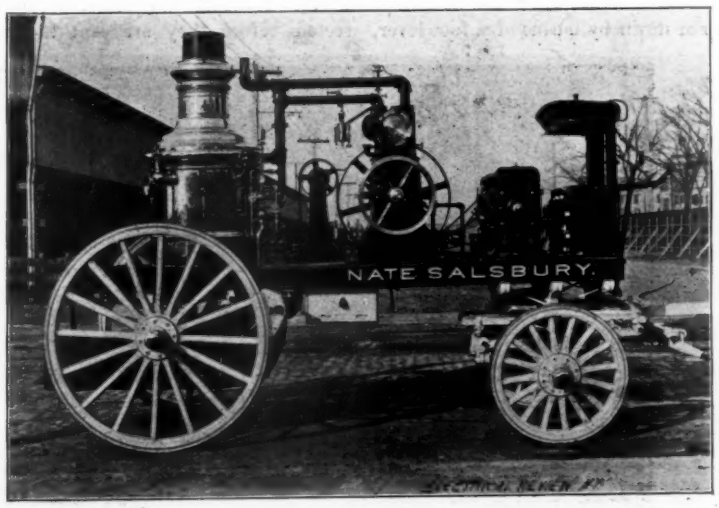
Five-cent telegrams are to be tried in Italy. The government is also trying to have the tariff with other European countries reduced.

A conservative estimate places the daily consumption of incandescent lamps in the United States at 35,000.

PORTABLE ELECTRIC LIGHT PLANT.

ELECTRICITY BROUGHT TO THE AID OF BUFFALO BILL'S WILD WEST SHOW IN AN INGENIOUS MANNER.

The ELECTRICAL REVIEW presents to its readers this week an ingenious and entirely original portable electric lighting plant designed by Mr. Thomas A. Lewis, the well-known and highly capable engineer of New York city, and constructed by his firm, Messrs. Ridsdale & Lewis, 39 Cortlandt street.



A PORTABLE ELECTRIC LIGHT PLANT FOR BUFFALO BILL'S WILD WEST SHOW.

A great number of plans were submitted to the officers of Buffalo Bill's company, and as there was no precedent for such work the plans and suggestions, as might be inferred, were widely apart. The decision of the company to accept the proposal of the above contractors resulted in most satisfactory work, and the progressive electrical superintendent of the show, Mr. M. B. Bailey, is highly pleased with the result.

Two wagons with their loads were constructed as above, one being named "Nate Salsbury," after the vice-president, and the other "Buffalo Bill," after Colonel W. F. Cody. Each plant consists of twenty-eight 2,000 candle-power arc lamps which are to be used for lighting the road show of the Buffalo Bill Wild West Company. The weight of each load, boiler, engine and dynamo with coal and water, is five and one-quarter tons and is carried on springs as shown, and both wagons appear in the street parades. They can be hauled around easily with two horses, but six are generally used for parade effect. The whole apparatus requires two hours to erect and turn on light. The Case engine is used for the source of power and proves to be a model of efficiency for the duty, and the design throughout is so compact and thoroughly practical and effective that we feel that a special word of praise is due to Designer Lewis for his pronounced success in this original work.

The company is at present exhibiting the Wild West Show in Philadelphia, corner Eleventh and York streets, and will be there the balance of this week. Our electrical readers in the different cities visited by this show during the season will find it very interesting to inspect these plants and will be sure of a cordial welcome from Mr. Bailey, the electrical superintendent.

National Electric Light Association.

President Wilmerding, of the National Electric Light Association, has called a meeting of the Executive Committee for Saturday evening, May 4, at seven o'clock, at the Grand Central Palace, Lexington avenue and Forty-third street, New York city. Secretary Porter has issued invitations to members of the electrical press and others to dine with the committee, who will discuss the plans for holding the next meeting of the association in New York city as outlined in the ELECTRICAL REVIEW last week.

The city of Chattanooga, Tenn., is inviting bids up to June 3 for the erection of a municipal plant, 300 arc lights, and also for lighting the city with electricity and supplying from 175 to 250 arc lights. Address J. O. Martin, chairman of light committee.

The General Electric Company's Porcelain Factory at Schenectady, N. Y.

One of the interesting features of the growth of a great manufacturing concern is the manner in which varied and widely differing industries are included as the progress of development advances. At the outset a large dependence is placed upon the outside manufacturer for raw or partly finished material, but as the art progresses and higher standards are required, the outside manufacturer is no longer able to meet the demand. The principal manufacturer is thus thrown upon his own resources, with the result that he generally succeeds in producing something much better adapted to his needs than that which he formerly was obliged to procure elsewhere.

A striking example of this evolution by necessity is furnished by the very complete factory for the manufacture of porcelain for electrical purposes which the General Electric Company has established as an integral part of its immense establishment at Schenectady, N. Y.

An especially perfect porcelain of hard, white, vitreous character, dense in structure, non-absorbent and unaffected by acids, alkalies or gases was demanded, and efforts were made to obtain such porcelain outside but, it is said, without avail. Confronted with this difficulty the company decided to build its own porcelain factory. This has now been in operation for the last three years with excellent results. It comprises mixing, moulding, drying rooms and kilns and stands a few yards away from the eastern division of the works, between Kruesi avenue and the New York Central Railway. It is equipped with the latest and most approved machinery, and is operated by a corps of skillful workmen under the careful supervision of an experienced man. Although only a pottery in miniature it is a complete pottery.

The building is a two-story brick structure covering a space of about 14,000 square feet. Through the roof protrude the squat chimneys of the kilns, which are kept in continuous service with the constant rush orders.

Entering the main door admission is immediately had to the mixing-room, where the crude kaolin or china clay, which is the best for the purpose that the market can supply, is brought to be washed, manipulated and mixed. Passing from the mixing-machine the clay is placed in bags and is strained through them to remove any material of a hard nature which might interfere with future operations. It comes from the straining press in large lumps and in that condition is partly dried, placed in a pulverizer and reduced to the necessary condition for transmission to the press-room, which it reaches in the shape of a moist, grayish, disintegrated clay.

The press-room is immediately over the mixing-room, and is well lighted and ventilated by large windows on three sides. The presses in which the porcelain is moulded are upright screw presses and stand along the three sides of the room directly under the windows. The operations in this room appear very simple, but it is here that porcelain of the most intricate shapes and fashions is turned out to meet special orders. The moulds used are of special tool steel, which are made in the works themselves by a corps of efficient tool makers. Before cutting these moulds, or dies, the shrinkage of the porcelain in drying and baking is calculated to a nicety in order that, when the porcelain in its finished state leaves the kilns, the metal parts which have been stamped out in the punch press house a few yards away may fit accurately. The catalogue number of the porcelain appliance is cut in the die, and this appears in relief on the base of the finished device.

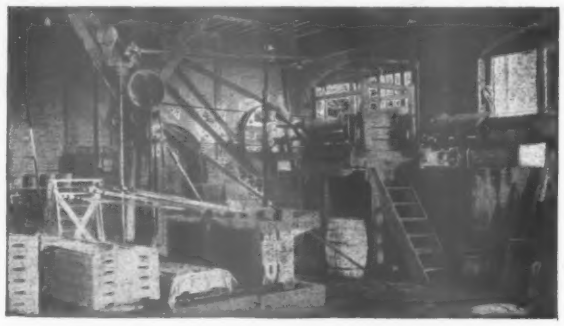


FIG. 1.—GENERAL ELECTRIC COMPANY'S PORCELAIN FACTORY, MIXING-ROOM.

The lower part of the die is fixed to a small table, which can be moved up or down by means of a foot lever, and is set in a hollow space in the larger table, forming the base of the press. The upper part of the mould is fitted to a sliding bar, which is elevated and depressed by the lever and screw. The die being fixed in position, the pressman takes a portion of the pulverized clay and weighs the proper quantity in a pair of scales. With a small brush the two dies are then thoroughly dampened, the lower mould is lowered to its normal position and the operator pours in the clay, which he presses evenly down with his hands to give it a preliminary packing. A vigorous twist is given to the lever and the upper die is brought down upon the clay with considerable pressure which is increased by an additional pull at the lever. Another twist in the reverse direction, and the upper mould rises, the lower one being elevated by the foot lever at the same time. Depression of the latter lowers the lower die, and leaves the mass of clay which has assumed the form desired in the hands of the workman. This with others is laid upon a rack in order that the pieces may undergo a process of air drying. The entire space in the center of the press-room as well as a part of the second floor of the main building is occupied by these racks. They are always full, for the press-room is taxed to the utmost.

A door in the press-room opens into a spacious room which occupies part of the second floor of the left wing and the whole of the main building. In this room all the pieces are corrected before they are sent to the kilns. The burrs are removed from all the holes through which screws or punchings are to pass, the marks of the dies are cut off, and the pieces put into final condition for baking. Through this room pass the upper parts of the kilns.

FIG. 2.—GENERAL ELECTRIC COMPANY'S PORCELAIN FACTORY, CORNER OF PRESS-ROOM.

Decending from this clay-finishing room the kiln-room on the ground floor is reached. The pottery kilns are four in number, and were constructed by one of the best kiln builders in Trenton. Around the kilns stand piles of yellow "hillers" and "saggers" which are made in one corner of the kiln-room. Into these clay pots or pans the moulded pieces are placed. When full a cover is placed over each, and hermetically sealed. The kiln is then filled and the doors closed.

After the first baking the porcelain comes out in the form of a hard, white, compact biscuit. For certain insulating purposes, this biscuit is employed as it comes from the kilns. It is non-absorbent to a high degree, and is used for socket bases and other purposes where the porcelain is not exposed. For switch bases, insulators, cut-outs, etc., however, the porcelain is glazed, and subjected to another firing. When it leaves the firing kiln it is as nearly perfect as the potter's art can make it. It is beautifully white, compact in texture, extremely hard, is unaffected by moisture and has exceedingly high insulating properties.

From the kilns the porcelain which is to be used in cut-outs, switches, sockets, transformer connecting boards and in many other appliances, is taken to the second story of the right wing of the building, where these appliances move along from operation to operation with a rapidity which speaks volumes for the dexterity of the workers. Here the brass punchings are applied to the cut-out, the screw shells fastened to the connections, the screws set and the insulating composition applied where needed. In another part of the room are made the thousands of key and keyless sockets, with porcelain bases and polished brass shells, and millions of glass fuse plugs for the plug cut-outs. At the table where the plugs are made a striking feature is the electric soldering devices, used to solder the fuse metal to the tip and exterior screw shell of the plug.

The assembling of ratchet snap switches occupies a little department by itself, as does the manufacture of the copper terminal fuses for link cut-outs. In sundry other portions of the large room other porcelain

appliances of varied character are made ready.

The finished appliances are then passed on to the next room where, each neatly wrapped in tissue paper, they are packed in brown card boxes, bearing a label showing their source and giving their description.

The insulators for special work, such as for transmission at very high voltages, are tested in a small room adjoining. During the visit of the writer an electrician in this room was busily engaged in testing the large double petticoat insulators for the important Folsom-Sacramento power transmission plant. Each insulator is subjected to as severe a test as could be devised, and before being accepted as satisfactory must show its capability of withstanding a pressure of 25,000 volts alternating. In order to test the endurance of these insulators, the testing current was raised as high as 52,000 volts before any of those subjected to the test gave away. The only trace of the enormous pressure then apparent on the outside of the insulator was a pin point hole scarcely perceptible.

In the use of porcelain as the most convenient and satisfactory insulating material, the General Electric Company claims to be the pioneer. Long before porcelain was used by other manufacturers the appliances of this company were widely employed and had earned a high reputation for excellence. Gradually electrical manufacturers came to recognize the merits of porcelain, as the electrical consumer had done already, and porcelain has come into much more general use, until to-day it is used almost universally for insulation purposes.

FIG. 4.—GENERAL ELECTRIC COMPANY'S PORCELAIN FACTORY, CORNER OF ASSEMBLY ROOM.

The council committee, the Board of Public Works and the city attorney have perfected the ordinance for putting electric light, telephone and telegraph wires underground in Indianapolis, Ind.

ELECTRIC LIGHT FLASHES.

South Haven, Mich., is thinking of buying an electric lighting plant.

An electric light company offers to illuminate Atlantic City, N. J., for 20 cents per arc lamp nightly.

The electric power is to be brought to Buffalo through a tube filled with a conducting liquid.—*Buffalo, N. Y., Enquirer.*

Webb City, Kas., has let contracts for building an electric light plant, the aggregate amount of the contracts being $13,892.

The Lockhart, Texas, Electric Light Company is reported to be in the market for a 750-light direct-current dynamo of 115 volts.

The City Council of Moorehead, Minn., has accepted plans for the new electric light plant and pumping station to be built this Summer.

The aldermen of El Dorado Springs, Mo., have granted a 21-year franchise to W. B. Lewis for an electric light plant, work on which must be begun at once.

A movement is on foot in Bainbridge, Mass., to organize a stock company to put in an electric light plant. It is necessary that $7,800 should be subscribed.

The gas company at Brattleboro, Vt., is considering the advisability of putting in a plant to furnish electric power for small manufacturers and users, and will do so if there seems to be a sufficient demand.

The Edison Electric Light Company, of Philadelphia, in order to take advantage of the recent concession by councils, which opens up new territory, has made an allotment of new stock at par in the ratio of seven shares to each 100 now outstanding. This will provide the company with sufficient funds to make all extensions contemplated.

FIG. 3.—GENERAL ELECTRIC COMPANY'S PORCELAIN FACTORY, VIEW OF KILNS.

A petition asking that a first mortgage for $1,100,000 and a subsequent mortgage for $1,700,000 on the property of the St. Joseph Light and Traction Company be foreclosed and a receiver appointed to take charge of the company's affairs, was filed in the United States Circuit Court at St. Joseph, Mo., on April 19. The plaintiff is E. Francis Hyde, of New York, second vice-president of the Central Trust Company, which holds the mortgages.

The Madison Square Light Company of New York city has mortgaged all its rights, privileges and franchises to the State Trust Company for $500,000. At a meeting of the company on April 22, the president and secretary were authorized to issue bonds to an amount not exceeding $500,000 to pay off the indebtedness incurred by the acquisition of the East River Electric Light Company. The mortgage was filed on April 23. Bonds of $1,000, $500 and $100 each, payable in 1925, drawing five per cent interest, were issued.

Is this President Colvin of the Interior Telephone Company?

Can it be possible that the Interior Telephone Company, of New York city, has absorbed the Western Electric Company? The following item in the Moline, Ill., *Dispatch*, of April 20, 1895, would seem to indicate that a coalition of some sort has been made and that there are wheels within wheels, even in the telephone business:

Frank R. Colvin, representing the Western Electric Company, visited Newark, Ohio, on the sixth inst., and as a result of his investigation of the apparatus used by the opposition company, the Western Electric Company will undoubtedly bring suit for infringement of the following patents: Button shunting generator on magneto infringes the Watson patent No. 270,522, fourth claim of January 9, 1883; hook on magneto infringes Roosevelt patent No. 215,837; weights on switchboard infringes Watson patent No. 280,266, of June 26, 1883; keys on switchboard infringes Watson patent No. 256,258, of April 11, 1882; clearing out drops infringes Eldred patent and fifth claim of Kellogg patent; looping cord in and combination of induction coil with any kind of switch that cuts in and out are also infringements used by the opposition. Mr. Colvin also visited Norwalk and intends, we learn, to bring suit against the Harrison company for infringement of these and other patents which are the property of the Western Electric Company.

Sweet Electric and Manufacturing Company Gives a Chattel Mortgage.

A dispatch from Grand Rapids, Mich., says that the Sweet Electric and Manufacturing Company has given a chattel mortgage in trust to E. H. Donnally approximating $12,000. It covers the tools, implements, stock and patents of the company. Claims for labor range from $3 to $75. The largest creditor is the Old National Bank of Grand Rapids, whose account is $1,163. Among other principal creditors is the W. J. Johnston Company, Limited, of New York city, publishers of our tea-green con., whose claim is for $610, presumably for an advertisement of the Sweet company, headed "Life-Death!" This is the only claim against the company in New York city so far as known.

Wonderful Growth of the Electric Railway in the United States.

These five years have indeed done wonders in the domain of street railroading in this country, and have even set our transatlantic friends to work following our example, says Joseph Weltzer in *Scribner's* for May. To give some idea of the extent to which electricity has displaced the horse, and, on the other hand, been instrumental in creating new roads, we need only cite the fact that at the present time there are over 850 electric railways in the United States, operating over 9,000 miles of track and 23,000 cars, and representing a capital investment of over $400,000,000. What stupendous figures, when we consider that in 1887 the number of such roads amounted to only 13, with scarcely 100 cars.

EFFECTIVE ELECTRIC LIGHTING.

BY W. PERREN MAYCOCK, M.I.E.E., IN LONDON "ELECTRICAL ENGINEER."

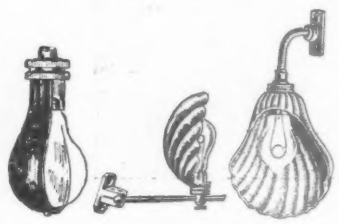
How few electrical fitters know what is meant by effective electric lighting; and of those who do know, how few take the trouble to apply their knowledge to their work. The result is that in ten out of a dozen electrical installations there is too much glare; by this I do not necessarily mean too much light, but too much light thrown in wrong directions. Unshaded lamps are placed so that they throw their light into the spectators' eyes and dazzle them. Especially is this noticeable in badly-lighted shop windows, showrooms, etc., where attention is attracted to details of objects, and the effect of the glare is more apparent than if a cursory glance only were taken.

Because of all this we are constantly hearing persons who, while admitting the superiority of the electric light in every other respect, wind up with the fallacious query, "But isn't it bad for the eyes?" Any intense light, especially sunlight, is bad for the eyes if it is allowed to shine directly upon their retinas. No sensible persons think of looking at the sun—they know what to expect—yet they will stare fixedly at an unshaded arc lamp, and on looking away to other things, and finding that they are dazzled, go away with the thought that there must be something very bad about the electric arc light, which, by the way, approaches more nearly in its character to sunlight than any other artificial light.

The effect of glare exists to a greater or less extent with any unshaded light—gas, oil, or electric. Take an ordinary table oil-lamp, for instance, and try reading a newspaper or book, first with the shade off, and then with it on. The irritating effect of the naked light, and its complete absence when the shade is on, especially if the shade is quite opaque, will be quite noticeable.

The distinctness with which objects are seen does not depend so much upon the actual amount of light in a room, as upon the amount of light received by the eye by reflection from the objects themselves. Say one is looking at a picture, and a naked candle is held by the side of it, by far the greater portion of the light received by the eyes proceeds direct from the candle itself; the eyes are consequently dazzled, and the picture is but indistinctly seen. If, now, a shade, such as the hand, is held between the candle and the eyes, the light received by the latter proceeds from the surface of the picture, which is then seen to greatest advantage.

The pupil of the eye, which is the opening through which the rays of light are admitted to the retina, is constantly altering in size according to the amount of light thrown upon it. The less brightly an object is illuminated, the wider must the pupil dilate in order to render vision clear. When an object or objects are very brightly illuminated, the pupil contracts, to prevent an unnecessary amount of light from entering. The effect of light upon the pupil may be studied with a hand looking-glass and a candle. Stare fixedly at the candle flame for half a minute, this will have the effect of closing up the pupil until it is very small in diameter, as will be seen on looking at its reflection in the glass. It will then be observed to gradually dilate, owing to the less illuminated surface of the mirror. Now shut the eyes for two or three minutes, shading them from the light of the candle, and on opening them and looking at the glass the pupils will be found to be much dilated, and they will then gradually close up to suit the brighter light, especially if the candle be held near them. A person coming in from outdoors at nighttime has no difficulty in seeing things, as the pupils of his eyes are already widely dilated in his effort to distinguish objects in comparative darkness. On the other hand, anyone going from a well-lighted room



FIGS. 1, 2 AND 3.—INCANDESCENT FIXTURES.

into a dimly lighted one, or into the street, will not be able to distinguish objects until his pupils have gradually dilated to the necessary extent.

The glare or dazzling effect of unshaded lights will now be understood. When one enters a room where there are a number of unshaded incandescent lamps, the eyes instinctively turn towards them, and the bright rays from the filaments cause the pupils to contract. On looking away from the lamps to objects about the room which do not reflect such intense rays, even though they may be well illuminated, they are indistinctly seen until the pupils have had time to dilate to suit the vision to the less illuminated surfaces. Unshaded lamps have this effect, even when they are not looked straight at, if their rays fall obliquely through the pupil upon the retina of the eye.

Electric lamps, both arc and incandescent, require shading much more than do gas or oil lights, as in the former we have a great amount of light proceeding from a very small area, and the rays are consequently much more intense. Compare the area of the filament of a 16 candle-power incandescent lamp with that of a gas jet of the same power. The light of the latter being more diffused does not exercise such a dazzling effect upon the eyes.

Whatever kind of light be used, the most perfect way of using it is to so arrange the lamps that no direct rays can reach the eye from the source itself; the light should be either wholly reflected from surrounding objects, or diffused, preferably the former. In the first case, neither the lamps nor their globes can be seen; in the second, the lamps are surrounded by translucent globes, which diffuse or split up the rays from the arc or filament as they pass through.

The competition among electric light fitters, and the consequent cutting down of prices, is no doubt the cause of much of the bad work to be seen everywhere. Shades cost money, and so do intelligent fitters; but even when good prices are obtained the proper shading of the lights is often not seen to, in order to increase the profit—a very short-sighted policy, as almost any one can appreciate the difference between a well and a badly-lighted room, though they may not be able to give reasons. In many cases, where there is no stint either of money or material, the final result is deplorably bad, through simple ignorance on the part of the foreman, and often also of the superintending "engineer," of the proper distribution and arrangement of lights—a matter which, after all, is very simple, as we have shown above.

When shades are used the lights are often too much shaded, so that an unnecessary amount of light is cut off. It is only necessary to shade lamps on that part which could be seen by a person in the room. For instance, in the case of a wall bracket in a room where general illumination is required, the rays from the lamp in the direction of the wall, the ceiling, the floor, and across the room above the level of one's head, should be unimpeded. This could be best done by having a shade to each lamp of the shape shown in Fig. 1, the shade being tapered off more or less at the top and bottom, according to the height at which the lamp was placed. These shades are made of nickel or silver-plated metal, or of porcelain or ground glass; and they are capable of being turned round on the lampholder so that their position may be adjusted. In conjunction with ornamental brackets they would not look so plain as when seen alone, as shown in the figure. They might be rendered more artistic by serrating the edges, and in the case of porcelain or ground glass ones, by painting floral designs on the back on an opaque colored ground. Figs. 2 and 3 illustrate forms of shell reflectors of nickel plate and ground glass, respectively. The fittings there shown are intended for shop-window and showroom lighting, but the reflectors could, of course, be applied to any form of fitting. For the general illumination of a room, the shade in Fig. 2 cuts off too many rays at the top, while that shown in Fig. 3 cuts off too many at the bottom; but in

FIG. 4.—INVERTED ARC LAMP.

any case they would prevent rays from striking the eye. Shades made of natural shell are very effective, the pearly white interior of the shell forming a very good reflector, while the shell itself, being slightly translucent, allows a soft and diffused light to pass through.

The most natural method of illumination, like daylight illumination, would be a general distribution of light all over the room in the manner above described; but in some cases, as in dining-rooms, studies, etc., many people prefer to have the majority of the light thrown on the table, the rest of the room being comparatively dark; but in these and in any other cases, whatever the distribution of the light, no direct rays from the filaments should be allowed to fall on the eyes.

Some eyes are more sensitive than others to bright spots of light in a room, as from unshaded lamps; and with everybody these have a tendency to keep the pupils of the eyes in a partially contracted state, which unfits them for obtaining the best visual effect when turned to less illuminated objects. When a given number of lamps are shaded, according to the character and material of the shades, from 30 to 50 per cent of the light may be cut off, and yet things are seen more distinctly than if the lamps were unshaded, for the reason that the rays of light reach the eyes from the most effective source—viz., from the surface of the objects in the room.

When arc lamps are used, owing to the much greater amount of light evolved for a given expenditure of current, a building or hall with a white ceiling of moderate height may be wholly lit by light reflected from the ceiling, the lamp being turned upside down, and the light thrown upwards by means of an enameled iron shade. Such a lamp is shown in Fig. 4, and is made by Mr. A. W. Richardson, of Worsley-road, Patricroft, near Manchester. This method of *inverted arc lighting* has been introduced into many workshops, and is a great success. In addition to the advantages to the eyesight already mentioned, there is the consideration that no sharp shadows are thrown by this reflected light. In one case, a room 24 feet square and 12 feet high, with a whitewashed ceiling and lit by one of the Richardson inverted lamps placed in the center, had a perfectly diffused light everywhere; the diffusion being so good that men sitting at benches with their backs to the lamp could carry out minute work with ease. Messrs. Lowcock, Hill & Company, of Blackpool and Manchester, also manufacture such lamps at their Cornbrook works. Improvements have recently been effected in the mechanism of the lamps made by this firm.

The advantages of such a light in workshops, leaving health considerations out of the question, will be appreciated by those who know what a workshop is like with numerous naked gas jets alight. There are brilliant spots of light here and there on the benches and over the machines, but the jets have to be moved about to suit the work, and even then they illumine it unequally, and give false ideas of shape and size. In cotton and dye mills the inverted arc system of lighting has already made good headway. The murky atmosphere prevailing in manufacturing districts renders artificial light necessary for a good portion of the working hours. And when at first it was attempted to replace gas by ordinary arc lamps, the latter were found useless on account of the hard shadows cast; but since the inverted lamp has been introduced arc lighting has much increased.

(To be continued.)

New York Electrical Society.

The April meeting of the New York Electrical Society was fixed for the 25th inst., when Mr. T. L. Willson was to have delivered a lecture on "Acetylene." At the last moment Mr. Willson had to leave for the West, and Mr. Edward Durant kindly filled the gap by repeating before the society on the 24th inst. his lecture given on the 16th before the Brooklyn Institute, on "The Manufacture in the Electric Furnace of Diamonds, Rubies, Aluminum and Acetylene Gas."

THE "WOOD" MULTIPOLAR DYNAMO.

THE FORT WAYNE ELECTRIC CORPORATION BRINGS OUT A NEW LINE OF MACHINES FOR LIGHT AND POWER.

Mr. James J. Wood, electrician and mechanical engineer for the Fort Wayne Electric Corporation, of Fort Wayne, Ind., has designed a new line of medium speed dynamos for incandescent lighting and power. The series of machines runs in size from 25 to 800 kilowatts, and the first machine built, with a capacity of 60 kilowatts, is illustrated in Fig. 1 herewith.

As will be seen from the illustration, the design of this dynamo, like all of Mr. Wood's apparatus, presents a very beautiful and substantial appearance, while the mechanical perfection of detail, workmanship and finish stamps it at once as a modern high-grade machine. In the several sizes up to and including 120 kilowatts, the lower portion of the field, pedestals and base is made in a single casting, while in the larger sizes, which have an outboard bearing, the parts are cast separately and bolted to the base, making the dynamo easier to install, as should the same design be maintained throughout the castings, it would become very heavy and difficult to handle.

A notable feature in this generator is the absence of all loose cables, wires and connections so common on many machines, the connections in this dynamo being made by removing the perforated door where they connect with the main binding posts, which are mounted on slate bases at each side, effectively protecting them from dirt or injury. The two small binding posts shown in front are for the field rheostat connections. The dynamo is compound wound and can

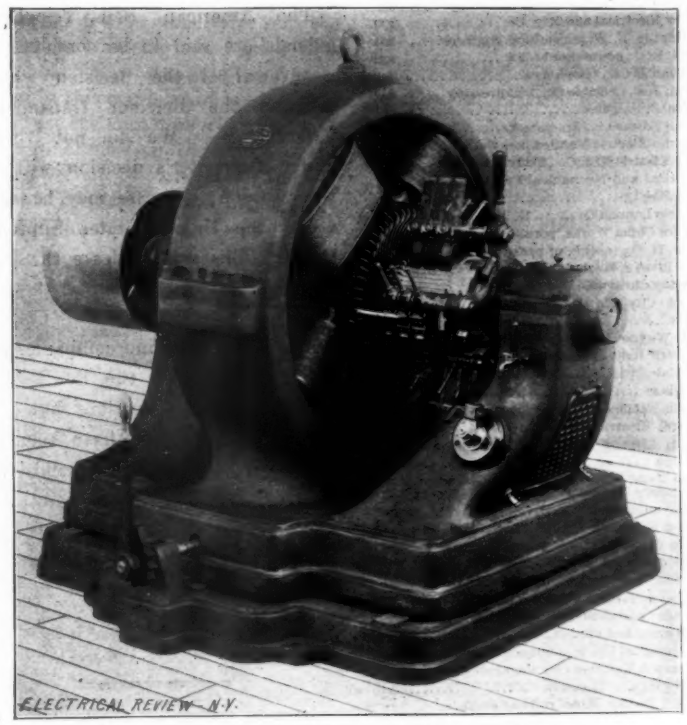


FIG. 1.—"WOOD" SIXTY-KILOWATT MULTIPOLAR DYNAMO.

be run in either direction by simply reversing the brush-holders on the studs and without changing any of the other connections, the brush-holders being so proportioned with relation to the commutator that the act of reversing them on the stud changes the point of contact 90 degrees, leaving them in the correct position for commutation when the dynamo is run in the opposite direction. The curved pedestal on the commutator end is also a decided advantage, as it not only reduces the floor space and weight of metal required in the base, but enables the dynamo to be turned end for end on the sub-base should it be required to belt from either end. The bearings are self-oiling and aligning, and are of ample proportion to withstand the strains to which they are subjected, while the field coils are wound on steel spools with brass heads, making them very easy to replace in case of an accident.

The armature construction of this dynamo (Figs. 2 and 3) possesses many novel features, showing in a marked degree the ingenuity and originality of the designer. Fig. 2 shows the commutator and core complete with one of the coils in place, while Fig. 3 shows one of the armature punchings, the method of building up the core, and one of the coils before being insulated. As will be seen from Fig. 3, the armature core is constructed from segmental punchings, having hooks projecting from the inner edge which partly enclose the clamping bolts. These punchings alternate with one another in order to break joints, the hooks making contact with the bolts on opposite sides, but without completing the magnetic circuit around them. It will be seen from this construction that the several segments are self-supporting, there being no strain on the spider or bolts other than that produced by the torque; as a consequence the spider can be of exceedingly small cross section and in marked contrast to the heavy cast-iron or steel structure so common in many multipolar machines, while the labor of fitting is reduced to a minimum, there being no dove-tails or other difficult fits to make. The hooks which engage with the clamping bolts not only break joints but alternate in position, leaving spaces between each equal to the thickness of the iron punchings. These hundreds of spaces enormously increase the radiating surface of the core, which, of course, reduces the temperature.

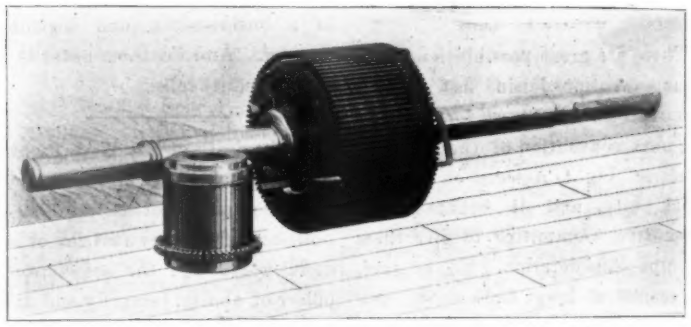


FIG. 2.—ARMATURE CORE AND COMMUTATOR, "WOOD" SIXTY-K. W. DYNAMO.

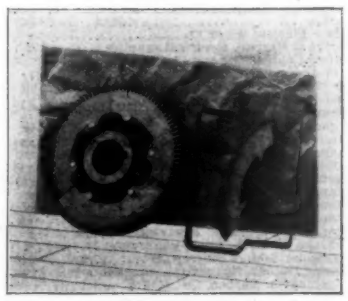


FIG. 3.—DETAILS OF ARMATURE CONSTRUCTION, "WOOD" SIXTY-K. W. DYNAMO.

A careful set of tests show that with this construction there is absolutely no current generated in the clamping bolts or spiders. Its advantages may be summed up in the following terms: 1. Minimum weight of armature. 2. Enormously increased radiating surface. 3. Self-supporting core construction. 4. Simplicity of spider construction. 5. Economical use of sheet iron. 6. Small cost for punching dies, and their maintainance.

This method adapted itself perfectly to armatures of large diameter and any capacity required. Those wishing a more detailed description of this construction are referred to Mr. Wood's patent No. 529,437 of November 20, 1894.

The windings or coils, which compose the armature circuit, are also of novel construction, and present features of extreme simplicity over the bar method of winding heretofore employed. As will be seen from Fig. 3, the coil is composed of four bare wires wound on a former with a heavy copper connector soldered at one end, which makes connections by screws to the commutator segments. The advantages of this construction are first, the soldered joints, so common in bar winding, at each corner with their tendency to get loose, are entirely dispensed with, there being but one soldered joint to each coil, in place of five in the old method. Second, as a consequence the resistance of a turn and the C^2R losses in the armature are materially reduced. Third, the four naked wires, of which the coil is formed, present a greater radiating surface in proportion to their area and consequently carry the currents generated in them at a much lower temperature.

After being formed in shape, as shown in Fig. 3, they are then carefully insulated and placed in position on the core, as shown in Fig. 2, the return ends being soldered into holes in the commutator connector before referred to. The commutator is then slipped on the shaft, each connection being screwed to its proper segment by two screws. As there is no strain anywhere on the insulation and as the voltage between each turn is very low while the ventilation is perfect, it would seem as though such an armature ought to be extremely durable.

The commutator of this machine, shown separately in Fig. 2, is constructed from hard drawn copper with mica insulation put together by hydraulic pressure, and both it and the brushes and brush-holders are of ample cross section for the currents which the dynamo is intended to generate, and as a consequence it does not heat. The armature circuits are so arranged and connected that either two or four sets of brushes can be used on the commutator. Either set can be removed while the dynamo is running and the remaining set will carry the current without overheating. On a recent test this dynamo was run on a load of 525 amperes at 120 volts for 10 hours, after which careful temperature readings were made. It was then found that the highest temperature in any part of the dynamo was but 35 degrees Centigrade above the room.

The dynamo weighs complete 7,300 pounds, while the armature weighs but 950 pounds, and at a speed of 650 revolutions per minute delivers 500 amperes at 120 volts, which can be raised to 140 when required.

Another new 150 horse-power boiler is being placed in the electric light station at Bellefonte, Pa.

ELECTRICAL REVIEW

Published at 13 Park Row,
P. O. Box 2339. NEW YORK.

EDITOR:
CHARLES W. PRICE.

ASSOCIATE EDITOR:
STEPHEN L. COLES.

REGISTERED CABLE ADDRESS:
"ELECTVIEW." NEW YORK.

1546 "CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
H. G. TUCKERMAN, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 800 H St., N. W.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy, - - - - - - - .10
Back Copies, each, - - - - - - .25

NEW YORK, MAY 1, 1895.

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Keep your eye on Niagara.

If the telephone had been as great a magnet for capital and capitalists when first announced, as it is to-day, inventor Alexander Graham Bell would have outdone the Count of Monte Cristo on suddenly acquired wealth.

Electrical inventors seem to be as prolific as ever in the production of novelties, specialties and other little aids to the easy and economical operation of electrical apparatus. There is lots of use in the electrical field for the man with "short cut" ideas and plenty of them.

The American Bell Telephone officials are said to be confident of a reversal of the decision which declared the Berliner transmitter patent void. We do not think Judge Carpenter's decision will be reversed, but the case may be sent up to the United States Supreme Court. This would please the Bell interests.

The new telephone companies are most numerous in the South and West. In these sections but few long-distance systems have been established, and the demand for reduced rentals is loud and long, and enterprising electricians are meeting with substantial encouragement in the establishment of new exchanges. There is yet a vast unoccupied field for the telephone.

The sustained strength and continued activity in the general market, together with other favorable conditions, constitute sufficient reason for the greater confidence shown everywhere in the business situation. It seems pretty certain that we are well along on the steep grade leading back to prosperity. It will be a long climb but a steady one and the most potent power for successfully making the trip is business confidence, which already seems to have been fairly well restored.

There are great possibilities in the ideas mentioned in last week's ELECTRICAL REVIEW for holding the next convention of the National Electric Light Association in New York city, and it behooves the Executive Committee to give them prompt consideration. To be sure, it seems a long time from now till June 1896, but past experience has shown that a year is all too short a time in which to plan a successful exhibition of any kind. A year from now business will undoubtedly be considerably better, money will be spent with more freedom and it is safe to predict that many new electrical devices will have been invented and developed. The ELECTRICAL REVIEW believes that this scheme can be successfully accomplished and it can be counted upon for support and for giving the proper publicity to the matter.

INCANDESCENT LAMPS.

With so many incandescent lamp manufacturing companies in the field—there are now more than 30—competition becomes pretty keen and it requires constant hustling by good salesmen to get orders enough to keep the pumps going. But good salesmen and hard hustling cannot build up a legitimate and lasting business if the quality of the lamps is not right. It would seem good policy for a manufacturer to make just the best lamp he knows how to make at the least possible cost, add a fair margin for selling expenses and profit and then let the merit of his goods win him business.

A good lamp at a fair price will always find a market, but the lamp that is put together hurriedly, slighted in any of the delicate processes necessary to produce quality and then sold at a figure lower than the legitimate manufacturing cost may have an ephemeral popularity, but it can't be forced upon the public very long at any price. "Quality tells" and never anywhere more than in an incandescent lamp.

The daily demand for incandescent lamps at the present time is conservatively estimated at 35,000 and this figure is bound to rapidly increase. The conduct of a manufacturing business which supplies a commodity to the general public must of necessity be regulated by the rules of good business which the general public is accustomed to in buying other supplies. This is a truism which will become more forcible every day. The lamp manufacturers of this country have now an open field and a wide market and it behooves them to take advantage of their opportunities in a business-like and legitimate manner. And let them never forget that "quality tells."

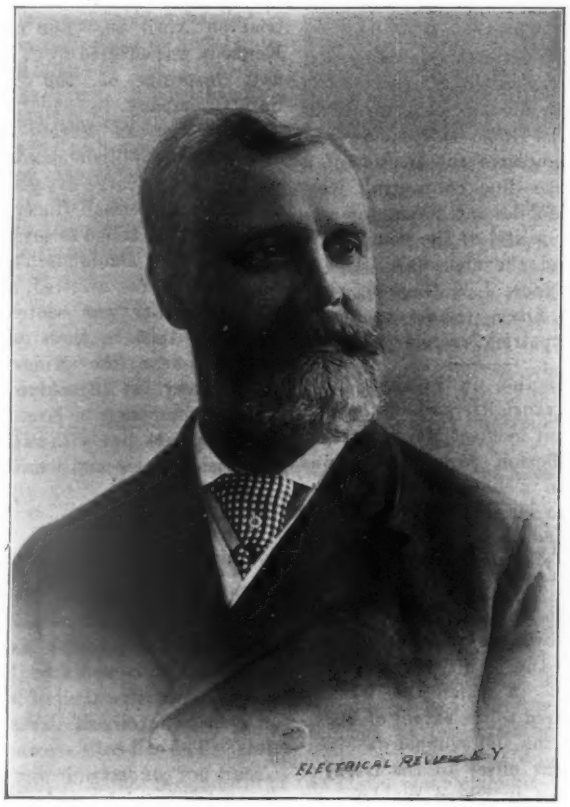
In the death of Mr. W. J. Richardson, of Brooklyn, N. Y., secretary of the American Street Railway Association, Brooklyn loses a citizen of high moral worth and the association an officer of ability, integrity and faithfulness. His place will be a difficult one to fill.

A glance at both the reading and advertising columns of the ELECTRICAL REVIEW will show that things are decidedly on the move in the electrical field. The move has been progressive ever since the first of the year, too.

Manufacturers of water wheels are viewing the developments in the electrical field with much interest and satisfaction.

Death of W. J. Richardson.

William James Richardson, of Brooklyn, N. Y., died at the Presbyterian Hospital in New York city on April 26 of spinal meningitis. He had been officially connected with the Atlantic Avenue Railroad Company, of Brooklyn, for 20 years and had been the secretary of the American Street Railway Association since its organization in 1882. No man was better known among electric railway people than Mr. Richardson, who was also a man of great moral character and standing as a citizen and a churchman. He was the son of the late William Richardson, who was popularly known as "Deacon" Richardson.



WILLIAM JAMES RICHARDSON, DIED APRIL 26TH, 1895.

Mr. Richardson was born in Albany in October, 1849. He was educated at the State Normal School and was also a graduate of the Polytechnic Institute in Brooklyn. He began his business career in 1867, after his father had become the manager of the Brooklyn and Jamaica Railroad Company, and three years later he was made Superintendent of the Brooklyn, Canarsie and Rockaway Beach road. When his father organized the Atlantic Avenue company in 1872 he became one of the directors, and was secretary of the company for a great many years. He was so much upset by the recent electric railway strike in Brooklyn that he had to give up all active business. He was fond of outdoor sports and had traveled extensively in Europe and in this country. He was once active in Republican politics, but of late years was devoted to the Prohibitionist party and accepted some of its nominations. Mr. Richardson was married 22 years ago to Mary Carrington Raymond, a daughter of President John H. Raymond, of Vassar College.

Wall Street and the Electrical Stock Market.

The General Electric-Westinghouse newspaper controversy petered out after conclusively establishing the fact that negotiations were commenced and that they are liable to be resumed at an opportune time. Interest was transferred to the forthcoming annual report. Copies have been received by a favored few in this city and the details are leaking out. Data thus far published substantiate the figures given in this column last week. It is said that the directors will report at the annual meeting that they regard it inexpedient to correct the impairment in the capital stock (about $14,000,000) at this time and will recommend that the matter be held in abeyance. It is thought that a general improvement in business will so enhance the value of the company's assets that it will be able to work out the problem without reducing the capital. As pointed out in this column months ago, one way of correcting the impairment is to buy in and retire the company's 5 per cent debenture bonds. Since then some $1,500,000 have been purchased, largely with assets derived through the sale of treasury securities. It is intimated that the Fort Wayne claim of $1,200,000 has been settled, as will be shown by the report, at about $200,000.

I understand that the company now employs 7,000 men, that its production is the largest in its history, and about twice what it was at this time a year ago. During the week the stock has been steady between 33¼ and 34. The highest prices were recorded late in the week.

Of the inactive stocks Edison Electric Illuminating of New York sold at 97½ to 98. The first 5's bonds recorded transaction at 106 to 106¾. North American was weaker, receding to 5⅜ @ 5¾. American Telegraph and Cable sold at 92. BAIN.

New York, April 27, 1895.

GENERAL ELECTRIC COMPANY'S ANNUAL REPORT.

COMPARATIVE BALANCE SHEET FOR THREE YEARS—AMOUNT WRITTEN OFF IS $2,291,844.

ABSTRACTS FROM THE REPORT.

At the request of the New York Stock Exchange, the annual report of the General Electric Company will be filed two weeks in advance of the annual meeting which has been set for May 14. It is stated that the report will not be issued until next week, but the ELECTRICAL REVIEW is enabled herewith to give an abstract of it which contains the gist of the whole thing. The comparative table of balance sheets speaks for itself.

The report of the General Electric Company for the year ending January 31 is as follows:

	1895.	1894.
Gross	$18,263,611	.....
Operating expenses	11,451,864	.....
Net profits	$1,811,747	$3,189,884
Other income	.. ....	510,038
Total net	$1,811,747	$3,699,922
Interest and taxes	464,583	695,350
Balance	$1,347,164	$3,004,572
World's Fair expenses	.....	241,877
Balance	$1,347,164	$2,762,695
Dividends	.....	1 655,150
Balance	$1,347,164	$1,107,545
Depreciation	933,521	.....
Surplus	$413,643	.....

The balance sheet of January 31 is as follows:

Assets.	1895.	1894.	1893.
Patents, plant, etc	$12,059,263	$12,100,392	$18,262,060
Real estate	433,787	323,685	296 720
*Stocks and bonds local companies	.....	2,723,493	9,173,251
*Stocks manufacturing companies	5,329,011	2,767,470	2,814,586
Accounts receivable	5,508,499	8,934,159	12,280,830
Inventories	3,913,787	4,834,792	2,076,502
Work in progress	846,291	1,198,343	2,207,982
Cash	404,236	591,144	3,871,033
P. and L. deficit	14,294,717	12,454,967	.....
Ft. Wayne claim and mis	1,176,666	.....	.....
	$43,956,257	$45,928,449	$50,934,973

*Combined 1895.

Liabilities:	1895.	1894.	1893.
Com. stock	$30,460,000	$30,459,700	$30,426,900
Preferred stock	4,252,000	4,251,900	4,236,900
Debentures	8,750,000	10,000,000	10,000,000
Mortgages	.....	26,200	.....
Accrued interest	72,917	83,333	83,333
Accounts, etc., payable	421,341	1,067,426	4,554,347
Sundry credits	.....	34,889	.....
Dividend unpaid	.....	.....	608,538
Surplus	.....	.....	1,024,954
	$43,956,257	$45,928,449	$50,934,973

The changes in the balance sheet during the year are:

LIABILITIES.	
Common stock increased	$300
Preferred stock increased	100
Debenture bonds decreased	1,250,000
Mortgages decreased	26,200
Accrued interest decreased	10,416
Notes and accounts payable decreased	646,085
Sundry credits decreased	39,890
ASSETS.	
Patents, unchanged.	
Plants, etc., decreased	$41,129
Real estate increased	100.098
Stocks and bonds decreased	161,952
Cash decreased	186,908
Bills and accounts receivable decreased	3,425,660
Inventories decreased	921,005
Work in progress decreased	352,052
Ft. Wayne claims and miscellaneous increased	1,176,666
Profit and loss increased	1,839,750

The report states that of the decrease in bills and accounts receivable, there was written off $2,291,844 accounts due by 466 persons which are now carried at $466, or $1 each person. These persons are now dealt with only on a C.O.D. basis.

It also calls attention to the fact that as a result of the Bate decision there will be less profit than formerly in the lamp business.

The Fort Wayne item among assets is a claim against that company held by General Electric. Last year the General Electric wrote down its holdings in the company to $1. This claim is in addition.

The important point is that the company earned gross in the very bad year, 1894, over $1,000,000 per month.

Its net earnings were 13.6 per cent of gross, showing the narrow margin of profit.

The seven per cent dividend on the preferred stock calls for $297,640 per annum, leaving for the common stock in the year 3.44 per cent. Of course, the charge off for depreciation, etc., was a conservative method, but the fact remains that the company did earn nearly three and one-half per cent on the common stock in such a year.

New York Office of the Forest City Electric Works.

The Forest City Electric Works, of Cleveland, Ohio, manufacturers of the well-known roll drop commutator segments for dynamos and motors, has established an office in New York which will have general oversight of the eastern territory. Mr. John C. Dolph, formerly connected with the Short Electric Railway Company and for the past two years eastern representative of the Eureka Tempered Copper Company, has been appointed manager of this district. It is the policy of the company to push vigorously the sale of their products in eastern territory. A large stock of standard street railway and lighting segments will be carried in their New York storeroom.

The Phœnix Electric Company.

The Phœnix Electric Company, of Hudson, Mich., is manufacturing high-grade incandescent lamps, using a new cellulose filament treated by its own special process. It makes a specialty of high candle-power lamps and manufactures a complete line from six to 500 candle-power. Mr. George F. Avis is the president of the company and Mr. Ralph R. Lane is secretary.

The National Academy of Sciences has awarded the Barnard gold medal to Lord Rayleigh for his discovery of argon in the atmosphere.

TELEPHONE NEWS AND COMMENT.

A number of Susquehanna, Pa., business men have organized a telephone company.

The legislatures of Minnesota and Arkansas have adjourned without passing any telephone rate bills.

Permission has been granted the New England Telephone Company to put its wires underground at North Adams, Mass.

Bell rates at St. Paul, Minn., have voluntarily been reduced from $4 to $3.50 per month for business houses and from $3 to $2 for residences.

It is announced that on May 1 reductions amounting in some cases to 50 per cent will be made in Bell rates at Cleveland. Party line circuits are being rapidly extended.

A telephone exchange is soon to be established at Peterborough, N. H., by the New England Telephone Company, who are now extending their line through there from Nashua to Keene.

Mr. L. Horton, Jr., has been appointed superintendent of the Philadelphia, Reading and Pottsville Telegraph Company with headquarters at Reading, Pa., *vice* E. R. Adams, deceased.

It is reported that 500 sets of Bell instruments have gone West since April 1 to meet the increasing demands for business in the territory of the Erie Telegraph and Telephone Company.

President Morris F. Tyler, of the Southern New England Telephone Company, last week argued against a reduction of telephone rates before the Connecticut Legislative Committee on Cities and Boroughs.

The big output of telephones for the past month ought to open the eyes of the telephone people. The reduction in charges will be more than made up for by increased business. It always works that way.—*Boston Herald.*

The American Bell Telephone Company's instrument statement for the month ending April 20, follows:

	1895	1894	Increase.
Gross output	18,794	7,517	11,277
Returned	6,253	4,698	1,555
Net output	12,541	2,918	9,722
Since December 20:			
Gross output	50,157	22,925	27,232
Returned	25,225	23,069	2,156
Net output	24,933	ret. 144	25,076
Total outstanding	623,583	584,707	38,876

The Texas Telephone and Electric Supply Company, of Dallas, Texas, with W. H. Thacker as manager, has been organized to construct telephone exchanges and electric light plants and to act as manufacturers' agents. The company will make a specialty of telephone construction and offer to install systems using wire fences as the line.

The Emporia Telephone Company has filed a charter with the Secretary of State for the purpose of maintaining a telephone company in competition with the Missouri and Kansas Telephone Company, in Emporia, Kas. The capital is $8,500 and the directors are as follows: C. Hood, L. L. Halleck, S. Strauss, T. H. Dinsmore, D. H. Stone, D. W. Morris and W. R. Irwin.

Leading counsel in the Berliner patent case of the United States *vs.* American Bell Telephone Company, recently argued in the United States Circuit Court of Appeals at Boston, do not look for a decision before July 1. The opinion has been expressed that the Court of Appeals will neither affirm nor reverse the decision, but will certify the case up to the United States Supreme Court for final decision.

The District Messenger and Telegraph Company, of Covington, Ky., which asked council some weeks ago to establish a telephone system in that city, has now a rival in the Tri-State Telephone and Telegraph Company, which offered a similar proposition last week. The latter company has a capital stock of $250,000

Cushioned Ear-Piece For Telephone Receivers.

and is incorporated under the laws of Ohio. It proposes to operate in Ohio, Kentucky and Indiana.

The Maine Telephone Company has elected these officers: President, Fred Atwood, of Winterport; treasurer, Edward Swazey, of Bucksport; secretary, T. W. Vose, of Bangor; directors, T. W. Vose, George P. Wescott, of Portland, and Fred Atwood. The president has been authorized to contract with or acquire rights from the Standard Telephone Company, to lease or acquire rights among local companies by purchase or otherwise, and to sell stock at par value in payment.

Clark E. Frear, proprietor of the Winola House, at Lake Winola, Pa., will construct a telephone line from that hotel to Falls Station. He has the franchise granted by the supervisors of Falls and Overfield townships, and has secured the right from the Valley company for the use of their depot at the lower terminus of the line. He will have the line completed not later than May 30. He also contemplates establishing a telephone line from Lake Winola to Scranton some time during the present year.

David Ross, a prominent citizen of Wichita, was in Fort Scott, Kas., last week inspecting the methods and working of the Mutual Telephone Company for the purpose of organizing a similar company in Wichita. He says there is no doubt that the new company will be organized and that at least 600 subscribers will be secured. The Missouri & Kansas Telephone Company's franchise has expired and the mayor and council of Wichita are in favor of granting a franchise to the Mutual company, which will in all probability be organized at once on the Fort Scott system.

Mr. Paul Minnis, manager and electrician of the Home Telephone Company, of Mobile, Ala., is visiting New York, Boston and other cities investigating various telephone systems. Mr. Minnis reports that his company has secured contracts with 5,000 subscribers in Southern cities and towns, among others 300 in Mobile. The Home Telephone Company contemplates the erection of a long-distance line connecting New Orleans, Mobile and Montgomery, Ala. The capital of the company is $40,000 and the officers are: Henry Piser, president; J. K. Glennon, vice-president; Adam Glass, treasurer; W. H. Fitzpatrick, secretary.

The reduction in royalties upon telephone transmitters which the Bell company put in effect March 1, 1895, says the Boston *News Bureau*, was based upon a sliding scale, and was not quite so large as the reduction in royalties made one year ago upon the telephone receivers or hand instruments, and which reduced the American Bell telephone royalty income last year by more than $1,000,000. Last year the royalty reduction was $1,011,000, in which the Western Union shared to the extent of $231,000, while the Bell company's $780,000 loss was offset to the extent of $113,000 by increased dividend returns. The Western Union suffers another similar reduction this year, but the Bell telephone reduction should be offset this year to a greater extent than last year by increased dividends.

Cushioned Ear-Piece for Tcephone Receivers.

C. Maynard Evans, 107 to 109 World Building, New York city, is introducing an improved pneumatic cushion for telephone receivers which is illustrated herewith. It is adapted to fit all makes of receivers and is made of soft rubber, fitted into a metal rim which springs or clamps over the end of the receiver, forming a complete air chamber designed to effectually prevent the buzzing or clicking sounds so annoying to users of the telephone. Its touch to the ear is soft, and the distance to the ear drum is more conveniently regulated than with the ordinary hard rubber receiver. An important improvement consists in the perforation of the cushion which does away with the suction which would otherwise be caused by pressing the cushion close to the ear.

The American Surety Company's Quick Action in Cases of Defalcation.

The Hudson River Telephone Company employed Thomas F. Kennedy as manager of its exchange at Saratoga Springs, New York, and took out a bond upon him in the American Surety Company, of New York city. Kennedy proved a defaulter and absconded from Saratoga at midnight, Wednesday, April 17, 1895. The American Surety Company was notified the next day and took immediate steps to trace the fugitive, which it succeeded in doing so successfully that they arrested him at Worcester, Mass., April 19, two days after his flight, from which point they returned him to Saratoga Springs, where he was committed for trial on April 20. The capture of Kennedy was effected by C. E. Holliday, inspector of the American Surety Company.

The American Surety Company also bonded William Baumbusch as cashier for the large dry goods house of Henry Batterman (incorporated), of Brooklyn. It had to pay $3,804.43 on account of Baumbusch's defalcation, but he was arrested, and after pleading guilty was sentenced on April 19, 1895, to three years' imprisonment in the Kings County Penitentiary at Brooklyn, N. Y. This company does a large business in its special line with various electrical companies and has been extremely successful.

Some Telephone Questions.

To the Editor of Electrical Review:

We have a line of telephone some two miles in length with six stations using two Blake and four Hunnings carbon transmitters, all of which are on a metallic circuit cut in all the time. The call bells are on a ground circuit not connected in any way with the metallic or 'phone circuit.

We are using one jar of battery to each station with fair results and do not have any trouble talking only in very wet weather and at night with an alternating system of electric light to contend with. Would we have better results by using more battery to each station?

Will it make any material difference if we add another station or two cut in the same as our present system is?

Truly yours,

C. G. Slocumb.

Keithsburgh, Ill., April 25, 1895.

Yes, the Air Is Free if You Have Ground Rights.

To the Editor of Electrical Review:

I have inquiries as to the right to run telephone lines to connect small villages for private and public purposes. From the best I can learn, individuals have a right to do so, provided they can secure the right of way along the route. Any information you can give would be gratefully received.

Respectfully yours,

B. F. McDonald.

Holley, N. Y., April 25, 1895.

LITERARY.

We have received "The Franklin Institute of the State of Pennsylvania for the Promotion of the Mechanic Arts: A Sketch of its Organization and History," compiled by William H. Wahl, secretary of the Institute.

The May number of *Cassier's Magazine* of illustrated engineering opens with a well-written and profusely illustrated article on "The Telephone and Its Operation," by Morgan Brooks, who was connected with the American Bell Telephone Company for several years.

The publishers of *The Intending Builder*, of Rochester, N. Y., have made arrangements with the Builders' Exchange Association of Buffalo, N. Y., who have indorsed the journal as the official organ of their exchange, and will remove their plant to Buffalo, May 1, taking offices at Nos. 41 and 42 Builders' Exchange. A large local subscription list has been assured the paper, and with a larger field for operations and increased facilities, the publishers hope to make a still more enviable reputation for their journal in the future than they have succeeded in establishing in the past.

Scribner's for May contains a unique feature in magazine fiction—the first part of the only serial story that Mrs. Humphry Ward has ever contributed to a magazine. It is entitled "The Story of Bessie Costrell," and is a most realistic and dramatic study of life among the very poor class of English farm laborers. This novelette will run through the May, June and July issues. It has this difference from Mrs. Ward's longer novels, that there are almost no passages of sociological or philosophical discussion, the purely human side of the tale moving rapidly and with great dramatic intensity to its closing scenes.

Twenty-three portraits of Bismarck, covering a period of 60 years, from his student days down to the present time, are the most striking feature of *McClure's Magazine* for May, all of the portraits being very interesting, and a number of them are rare. A paper on "Journalism," by Charles A. Dana, editor of the *Sun*, New York, gives the opinions which Mr. Dana has gathered from his own remarkably full experience, regarding the opportunities journalism offers to generous-minded and well-educated young men, and regarding the best preparation for newspaper work.

A New Line of Cut-Outs.

Edward J. McEvoy, 157 Cedar street, New York, late electrical constructor of the William Cramp & Sons Ship and Engine Building Company of Philadelphia, has recently placed upon the market a new line of cut-outs known as the "McE." cut-outs.

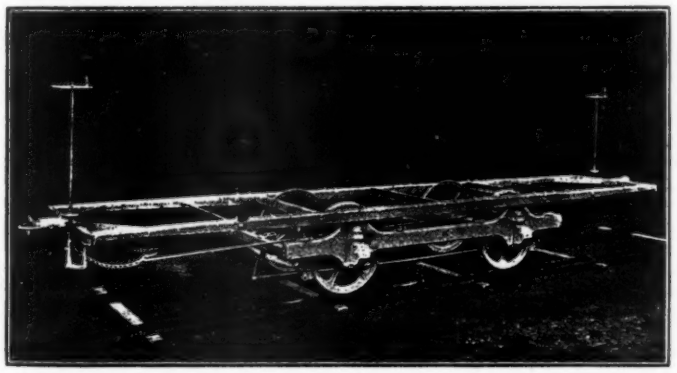
The bases of these cut-outs are of the best quality of porcelain and of elegant design and finish. Particular care has been taken in the construction of these cut-outs. The connecting bars are made from metal of the best conductivity running from end to end in grooves at right angles with the main wire grooves, which are divided by a solid wall of porcelain, thereby making it impossible for a short circuit to occur.

The main connections have a binding screw which, it is claimed, has no equal on the market. The branch connections are made by inserting the branch wires in a solid piece of metal through which a set screw penetrates, thereby making a perfect contact. Between the main and the branch connections is a receptacle in which a porcelain fuse cup is inserted. The replacing of the fuse entails no further labor than is involved in the loosening of two screws and detaching the fuse cup, which can readily be replaced without the slightest danger of short circuiting or arcing.

The cut-outs shown in Figs. 1 and 2 are especially adapted for large feeders, taking a 000 or 0000 wire easily. Fig. 3 is the same type but of smaller carrying capacity. Fig. 4 is a fuseless branch block mostly used in marine construction and is now being used on the "St. Louis" and "St. Paul," of the American Line, which are now being built in the William Cramp & Sons Shipyard at Philadelphia.

Motor Truck for the Madras, India, Tramways.

Trial trips of electric cars have recently been made with great success on the Madras, India, tramways. The illustration on this page, for which we are indebted to London *Lightning*, shows the underframe and motor truck of these cars, which are constructed of pressed steel parts on a well-known principle, by the Leeds Forge Company, Limited, of Leeds, England, and are supplied by them to the Electric Construction Company, the builders of the cars.



UNDERFRAME AND MOTOR TRUCK FOR THE MADRAS, INDIA, ELECTRIC TRAMWAYS.

This form of frame is claimed to be eminently suitable for electric cars by reason of its extreme lightness combined with great strength and elasticity. The weight of the frame is minimized by having no superfluous metal, and the pressing process enables the increased depth of flange to be placed just where additional strength is required. Pressed steel frames and motor trucks have been in use for some time in England for tramcars, notably on the Liverpool Overhead Railway and South Staffordshire Tramways.

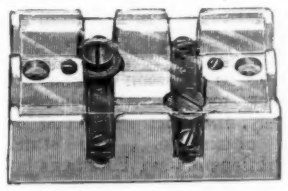


FIG. 4.—"McE." FUSELESS BRANCH BLOCK.

Mr. La Rue Wins His Suit.

Judge Wallace at New York city, on April 24, awarded George W. La Rue a verdict for $2,000 damages and costs against A. W. Cumner, of Boston, who was sued by Mr. La Rue for slander.

The Electric Motor the Only Hope in Aerial Navigation.

My opinion is, that the only motor which will solve the question is the electric motor, says Gaston Tissandier, in *McClure's Magazine* for May. It was I who first took out a patent for this idea, my patent being for "The application of electricity to aerial navigation." That was in 1881, and in a note communicated to the Academy of Sciences I explained the advantages of the electric motor. In the first place, it works without a furnace. Secondly, its weight never diminishes nor increases during its working, and it is set in motion with the greatest ease. Assisted by M. Gaston Plante and other savants and engineers, I was at last able to realize my project of an electric motor. * * * Our motor was not, however, of sufficient force to overcome that of the wind, and the best result obtained was that we remained stationary. When sailing with the wind, however, our screw propelled us in a very satisfactory manner. We were delighted with the easy working of the motor, and the result of this experiment was to confirm absolutely the principle that it is the electric motor that must be used. Although we did not make headway against a wind blowing at a rate of three metres a second, we were able to resist it and to deviate from its current by tacking, with the greatest facility.

Another Man Struck by Lightning.

TO THE EDITOR OF ELECTRICAL REVIEW:

In looking over a recent number of the REVIEW, I noticed the case of Mr. Clothier who was struck by lightning and was otherwise several times killed—or ought to have been, in the ordinary course of nature.

I am personally acquainted with another Iowa man who had a similar experience, the details of which you can verify if you care to do so. Mr. Geo. R. Knapp, of Vinton, Iowa, was struck by lightning several years ago—his hat was torn to shreds, the charge running down and breaking through his rubber boots, as I now remember the case. He has several scars on his body, is deaf in one ear and nearly so in the other. He is an intelligent man and is now in business at Vinton. The physician who attended him is also still in practice there.

It occurred to me the case might interest you, hence this letter.

Truly,

J. W. RICH.

Iowa City, Iowa, April 18, 1895.

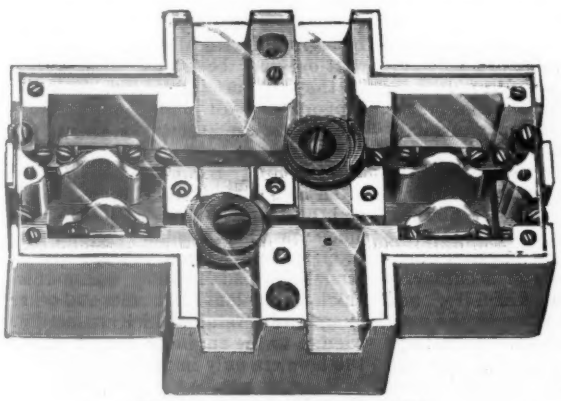


FIG. 1.—LARGE "McE." CUT-OUT.

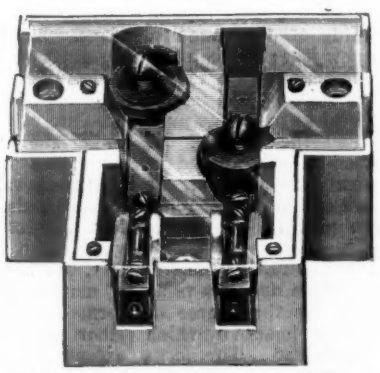


FIG. 2.—ANOTHER TYPE OF "McE." CUT-OUT.

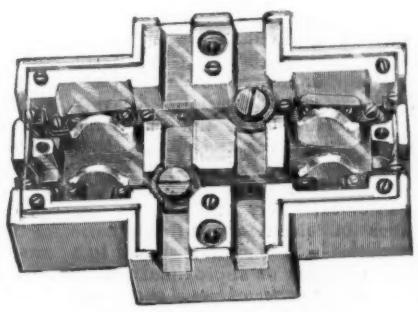


FIG. 3.—"McE." CUT-OUT.

THE SCIENTIFIC FOUNDATIONS OF ELECTRICAL ENGINEERING.

READ BEFORE THE NORTHERN SOCIETY OF ELECTRICAL ENGINEERS,
BY F. G. BAILY, M.A.

There is probably no branch of engineering which is more intimately connected with purely scientific knowledge, and which has received more attention from scientific men, than electrical engineering. The novel character of the forces which it employs, their intangibility and mysterious nature appeal strongly to the imaginations of the uninitiated, and seem to set apart everything connected with electricity as a class of phenomena about which very little is known or understood. On the other hand a certain amount of familiarity with the more usual phenomena and the acquisition of several formulas has produced in some minds a profound conviction of the truth of electrical theories, with an implicit faith in the accuracy of electrical measurements and the potency of calculation. While leaving the former attitude of mind to the gradual effect of familiarity, I wish to mention in this paper some of the limits to which we are still subject, and some of the errors to which we are specially liable.

The most powerful aid to improvement, and the greatest source of confidence in engineering practice, is undoubtedly by accuracy of measurement of effects and quantities in units which are common to all branches of physical knowledge. It is, therefore, useful sometimes to examine our foundations and realize what they mean.

In accordance with its close connection with pure science, the units employed in electrical engineering have been based on the so-called "absolute" system of units—that in which the centimeter, gramme and second form the fundamental quantities, the definitions of which depend on the physical properties of certain portions of the universe. Physical science refers all its measurements to these three fundamental units, and recognizes no others. As these units are independent, all calculations based on them may be accepted as rigidly accurate, and strictly comparable with one another. Abstract calculations are not, however, of much direct use to the engineer, and something more definite is required. Now the electromotive force of a battery, the current in a lamp, or the resistance of a piece of wire does not appear to be very closely related to grammes, centimeters and seconds, and, in fact, they can only be numerically estimated by indirect experiment. After a long series of extremely careful work the values of electrical and magnetic quantities have been determined to a certain degree of approximation, so that the values of any particular resistance can be expressed in centimeters and seconds to an accuracy of .01 per cent or even less.

The electrical and magnetic units are derived from the centimeter gramme second through the mechanical forces which the various quantities exert, starting from the force between two magnetic poles, and the force on a magnetic pole in a magnetic field. Hence current is measured by the strength of the field it produces, and electro-motive force by the motion of a conductor in a magnetic field. Resistance is defined as the ratio of these two. This system, however convenient for scientific purposes, does not lend itself readily to the reproduction of the units. In practical work it is important that the standard values should be readily reproduced and easily compared to others. On this account the Board of Trade have laid down that the practical standards, while being made as closely equal to the true absolute values as possible, shall be independent of them and independent of possible future more accurate determinations of the true values. The ohm is defined as the resistance of a certain quantity of mercury of certain length, and the ampere as a current which will deposit silver out of a certain solution at a certain rate. The volt is then the electro-motive force necessary to drive one ampere through one ohm.

In accepting these definitions, we really leave the centimeter gramme second system, and found another one very closely related, but arranged on a different and more convenient principle. To what extent is this accurate, and to what accuracy can we compare electrical quantities on this system?

It must be confessed that the measurement of electrical quantities has not the same accuracy as the measurement of the fundamental mechanical quantities, and the laws upon which they depend are not to be depended upon to the same extent. The laws of motion, laid down by Newton, have an accuracy which may almost be regarded as absolute. We have no reason for doubting them. The standards of length and mass may conceivably alter in the course of ages, but there is no evidence of such a change having taken place. But the electrical units are not so firmly established. The electrical resistance of standard ohm coils has been found to vary to a small extent, but this unit is the most satisfactory one, and comparisons between it and others can be made with considerable accuracy, one part in 10,000 being easily obtainable. The standard current depends on Faraday's law of electrolytic action, and though this may be theoretically very approximately true, its actual truth is marred by secondary actions, which prevent an accuracy greater than one part in 1,000. The volt depends on this, and therefore no measurement of current or of electro-motive force can be relied on beyond one part in 1,000.

This question of the limit of accuracy of measurement of the actual and relative values of quantities is one which is frequently ignored. There is no such thing as the knowledge of the absolute value of any quantity. We can only know its value to a certain approximation, and this should be definitely expressed by the figures used, and it is useless to try to push this limit beyond the limit of the standards. Sometimes this standard is very imperfectly known, *e. g.*, the value of the unit of heat is not reliable beyond one part in 400 at the most.

Frequently, however, the number of figures intended to denote a value are not justified by the degree of accuracy of the experiments by which it has been determined. The accuracy of a result is the accuracy of the weakest part, like the strength of a chain. The determination of other values involved to a much greater degree of accuracy is a mere waste of time, while the quoting of them is deceptive. How often does one see a reading on a galvanometer consisting of two figures expanded by a long division, or by the use of seven figure logarithm tables into a result of some five figures. The last three figures are purely gratuitous and are quite unreliable.

The same fictitious accuracy is often seen in the design of measuring instruments. It is not infrequently the custom to design voltmeters with an expanded scale over a short range, and to advertise accuracy of scale reading to one-tenth volt at 100 volts; that is, an accuracy of one part in 1,000. This is merely the seven-figure logarithm over again, it being useless to magnify the scale beyond the size where the errors due to friction and the effects of temperature and residual magnetism become appreciable distances on the scale.

Under this head I feel compelled to metion an instrument for which I have a great admiration, and which has recently been eulogized before another society. I refer to the potentiometer. The delicacy is very great, almost comparable with that of the Carey-Foster method of comparing resistances, the Whitworth measurement of length, and the measurement of mass by the chemical balance. and for comparative values taken at short intervals of time it is unrivaled in its own line. But for actual values it is like using a delicate balance with a set of letter weights, or a Whitworth machine with a common foot rule as standard. A delicate method of comparison is useless beyond the point of reliability of the standard, which in this case is one part in 1,000. Even this is by no means easy to attain. Such an accuracy on the silver voltameter requires great practice and very careful work, while the Clarke's cell requires just as careful handling. It is not an immutable thing like a gramme weight of platinum, crystal, or gilt brass, but it is generally used with as little regard for its peculiarities. Notwithstanding its large temperature variation, the worker ignores its previous condition, and with a light heart applies a thermometer and a table of corrections, as if the electromotive force had some direct connection with the mercury in the thermometer instead of being related only by the very indirect and slow-acting conditions of solution or deposition of sulphate of zinc.

The essence of applied science is emphatically the power of measurement for the purpose of checking the accuracy of previously calculated or estimated designs, and for investigating the properties of materials used, in order to obtain data for future work. We may divide experimental research into three classes. 1. Qualitative observation of the occurrence or non-occurrence of some phenomenon. 2. Comparative quantitative observation of the variations of a phenomenon, with change of conditions. 3. Absolute quantitative determination of the value of a phenomenon. The first two classes include the bulk of scientific research, for the absolute value is frequently of minor importance and depends on the particular piece of matter used, while the changes in value are common to a large class of bodies, and indicate physical loss. The determination of the absolute value of an important physical quantity, to a high degree of accuracy, is a matter of great difficulty, and forms the object of some of the most laborious investigations. To a large extent, however, the engineer can only deal in absolute values, because he immediately wishes to compare the result with that given by some other arrangement of his machinery. With him the all important question is by what method a certain result can be most economically obtained, using the word "economy" in its widest meaning. For instance, a physicist or chemist may be interested in the various processes in the production of mechanical energy by the consumption of coal. The effect of varying the supply of air to the fuel, the wetness of the steam, the result of altering the initial pressure, the expansion and condenser pressure, the surface condensation under different conditions, and many other points, are all problems of scientific interest, and may be dealt with separately. But the engineer must take all of these points into consideration at once, make the best compromise that he can between conflicting requirements, and sternly require of each improvement that the resulting increase in efficiency shall not be swallowed up by the increase in cost of plant and labor. Finally, he must compare the total result with that given by some other means of obtaining mechanical energy, in order to make a final decision.

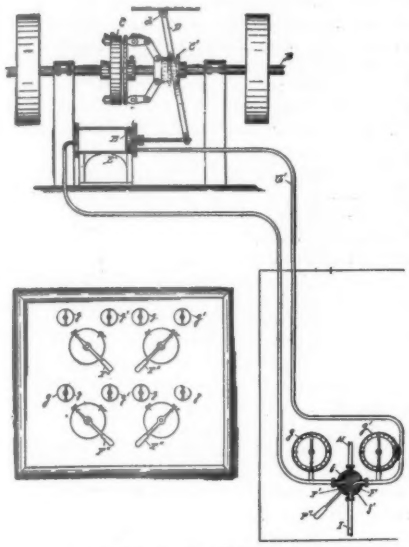
For this reason, therefore, the method of investigating engineering problems must to a certain extent differ from the purely scientific treatment. The scientist narrows the conditions of his problem and simplifies the phenomena until the result, though highly artificial, illustrates the action of a single law. For the engineer, on the other hand, it often seems difficult to avoid the combination of all the variables, and in consequence he hardly differentiates their individual effects, and does not always discern which of them are essential and where the point of weakness lies. That truly English panacea, a substantial factor of safety, is made to take the place of more precise knowledge, the additions being occasionally put in quite unnecessary places.

On the other hand, much time and energy is expended, especially by mathematicians, in elaborating hypothetical problems, the conditions being chosen to suit their method of analysis, and the desirability, and even the possibility of realizing those conditions being disregarded. This has been especially the case with alternating current problems. It seems a field so evidently made for mathematical treatment of an interesting nature, and so impossible to attack by any less rigid method of reasoning, that one almost feels called upon to give up the use of such an unreasonable material as soft iron, and even to abjure the use of most dielectrics, in order to rest in the security of an analytical demonstration.

It is necessary, therefore, to beware of the spurious accuracy of the page full of mathematics just as much as the seven figure logarithms. It has been pointed out, but the caution is frequently ignored, that mathematics are like a flour mill. The quality of the flour turned out is not better than that of the corn put in, and if not ground with due care and precaution, may be a good deal worse. If the data are unreliable, or if the proportion dealt with cannot be expressed as a mathematical function, the results can have but a very limited application. Examples of this are often met with in calculations of cost and efficiency, where wonderful coefficients and constants stand for interest, depreciation, labor, superintendance, load factors, commercial efficiencies, plant efficiencies and other quantities of values, which are familiar enough to the engineer, but of which the laws are only imperfectly known.

It must not be thought, however, that I wish to disparage scientific principles and methods in electrical or in any other branch of engineering. There is no other safe foundation, especially in electrical work. The agents and phenomena are so intangible and unusual that the old-time faculty of experienced intuition, by the light of which an engineer was supposed largely to work, is exceedingly difficult to cultivate, and frequently leads the possessor startlingly astray. What we want is more appreciation of actual working conditions in our mathematics, and a more scientific direction and greater breadth of applicability in our engineering experiments. This latter need is the weakest part of all engineering

science, and the most important. An isolated case of a machine which works well contributes little to knowledge. A similar case of one which works badly gives not much more information. But it is perhaps



AN HYDRAULIC CLUTCH OPERATING DEVICE.

unreasonable to expect manufacturers to build a series of experimental machines, each differing slightly in one particular, to settle the absolutely best conditions, or if this is done, as has been sometimes the case, the world at large can hardly expect to have the benefit of the work presented to it. Moreover, workshops are not the best places for research, nor is engineering experimental work a pastime at which untrained players can get results of any value. It is so easy to obtain some sort of result in experimental work; it is so difficult to attribute it to its true cause and to eliminate all side issues. From the nature of the case secondary actions crowd round the main point, and but few men have both time and ability for elucidating them. Much good work has been done in the factory, but, as stated above, it is generally of an unobtrusive nature. Much has also been done in physical and technical laboratories, and I venture to think that manufacturers, central station and consulting engineers will find that a greater amount of sympathy with these institutions, and mutual assistance and collaboration with them, will result in true economy to themselves and will greatly help to establish a firm scientific foundation for electrical engineering.

An Hydraulic Clutch Operating Device.

It is a matter of general remark that the use of friction clutches, clutch couplings and clutch pulleys is becoming more and more widespread in all sorts of engineering work, and especially is this the case in regard to electric lighting and power plants, where it is of the utmost advantage to secure the greatest flexibility of operation such as providing for the ready shutting down of any portion of the shafting without affecting the rest, and in disconnecting one or more machines without affecting those in operation.

In the operation of these clutches by hand considerable effort is required on the part of the attendant, and a great deal of running about is necessitated from the points where the clutches are operated to the switchboard, etc., and it is of the greatest advantage to be able to control the operation of these clutches from the point where the general control of the station is centered, namely, the switchboard. By the use of the system here described, which is an invention of Mr. J. Brodie Smith, of Manchester, N. H. It is possible by the simple turning of suitable valves to absolutely control the operation of any number of clutches or other power transmitting devices from the switchboard or other central point, irrespective of the distance of the different devices controlled.

The action of this device will be understood from an inspection of the accompanying cut, from which it will appear that hydraulic pressure is the means for accomplishing the desired end. Each of the clutches is seen to be provided with a double acting hydraulic cylinder connected with the lever. These cylinders are connected to a source of hydraulic pressure and to the operating point by means of piping, and situated at the operating point is a four-way valve in connection with each of the clutches, suitably arranged to provide for the turning on of the pressure to either piston of the duplex hydraulic center, or of cutting off the pressure altogether. In one of the positions of this four-way valve the hydraulic pressure acts upon the piston, which is arranged to throw the clutch in; in the reverse position of the valve, the pressure is acting on the piston, which acts in such a direction as to throw the clutch out, and by a careful manipulation of the valve the clutch may be thrown in and the load "picked up" very gradually. In connection with the hydraulic cylinders may be electrical contacts so arranged as to indicate at the central point the position of the clutch, whether in or out, and pressure gauges are provided corresponding to each clutch, showing in which way the clutch is moved, how fast it is moving and whether or not it has reached the end of its travel.

The character of this device would seem to be such as to appeal with great force to the practical central station man, who has had to accomplish the somewhat difficult task of being in two places at once—at the clutch levers and at the regulating rheostat—and it is believed that this arrangement is capable of extensive application throughout installations employing this way of transmitting power.

A Universal Distribution System for Light and Power.

The Siemens & Halske Electric Company of America announced last week the production of a universal system for the distribution of light and power from the same conductors. The results to be obtained by its use are shown graphically in the accompanying diagram. In an open letter to customers the company argues for the advantages of its new system, in brief, as follows:

For plants in cities and towns where the power house can be located near the center of lighting, we use the direct 220-volt two-wire multiple arc system of distribution. Public and private arc lights, incandescent lights and electric motors can be operated from a single dynamo, preferably direct-connected to an engine or water-wheel. The low-pressure system involves no danger to life.

The original cost of this system is usually less than that of a high-speed high pressure system. Recent determinations made for several cities show that while often more copper wire is needed, one dynamo is used in place of from four to six; and no countershafting, belting, friction clutches, transformers, or other energy-wasting

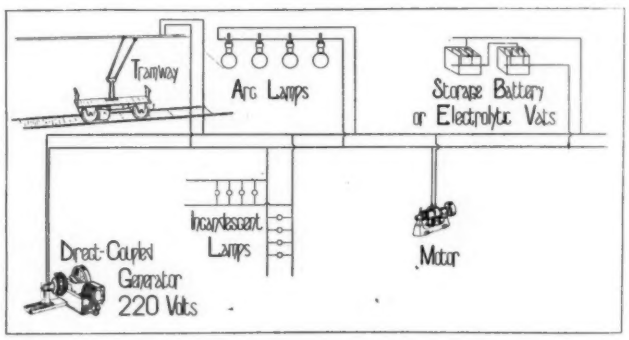


DIAGRAM OF A UNIVERSAL DISTRIBUTION SYSTEM FOR LIGHT AND POWER.

appliances; less real estate and a smaller building is occupied.

The cost of operation is from 20 to 40 per cent less. A single Siemens dynamo of slow-speed direct-coupled to a good engine costs less to operate than half a dozen high-speed machines belted to a shaft. We save in friction, oil, repairs, attendance, wear and tear and we obtain a higher efficiency.

Two hundred and twenty-volt incandescent lamps are now being made and guaranteed by many prominent lamp manufacturers in the United States and by Siemens & Halske in Berlin. The Edison incandescent lamp patent has expired and we are now importing the lamps of our parent company, and we are prepared to guarantee them fully. They are of high efficiency, long life and of uniform candle-power during their full life. Our 1,000 horse-power dynamo at the World's Fair operated daily nearly 4,000 incandescent lamps and 450 arc lamps and many motors, distributed over a wide area, without a hitch and to the perfect satisfaction of all concerned.

Another General Electric Factory?

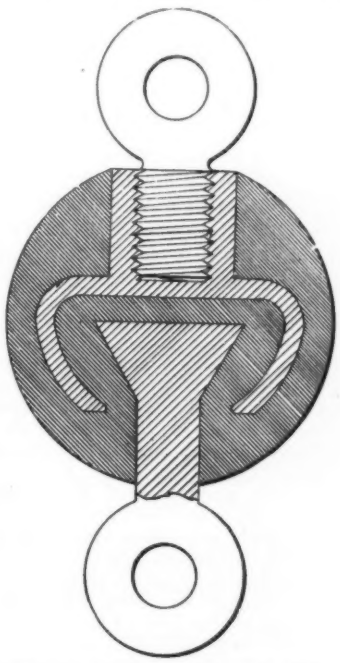
C. A. Coffin, S. Dana Greene and J. P. Ord, of the General Electric Company, spent several days of last week in Cleveland, Ohio. Local papers state that the General Electric Company is about to establish another manufacturing plant on Lake Erie, either at Buffalo or Cleveland, employing from 4,000 to 6,000 men. The report has not been verified.

Stanley Electric Manufacturing Company.

At a recent meeting of the stockholders of the Stanley Electric Manufacturing Company, at Pittsfield, Mass., it was voted to increase the capital stock of the company from $200,000 to $300,000. The business is rapidly increasing and there is a call for more capital, all of which can be profitably used. This company is one of the best managed and most successful manufacturing companies in the electrical field, and its success is largely due to the able and intelligent efforts of General Manager Henry Hine.

Western Electric Company's Spherical Strain Insulators.

The new spherical strain insulators for railway work which the Western Electric Company have just put on the market are worthy of note. They are of three sizes—one and three-quarter inches, two and one-half inches and three inches—and have a breaking strain of 3,800 pounds, 5,400 pounds and 6,300 pounds, respectively. As will be seen from the accompanying illustrations, their internal construction is ingenious and original. The eye, with the cone-shaped end, is cast in the malleable iron shell surrounding it, which, it is claimed, gives a greater insulating distance between the two castings, and a greater tensile strength than any other style of construction. The greater the strain on the insulator the more tightly pressed becomes the insulation immediately surrounding the cone—the tensile strength of the insulator being limited only by the strength of the eyes. One eye is made to screw into the malleable iron shell, which makes it detachable and allows the insulator to be tied into both ends of the span wire before



WESTERN ELECTRIC COMPANY'S NEW STRAIN INSULATOR.

being put up. The strength of the screw thread on these eyes is calculated to be three times as strong as the heaviest span wire now in use. These insulators, when insulated with the new compound of the Western Electric Company—the result of many months of experimenting in this line—have an insulating resistance of 139,000 megohms.

A METHOD FOR PREVENTING ARMATURE REACTION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK AND CHICAGO, MARCH 20, 1895, BY HARRIS J. RYAN AND MILTON E. THOMPSON.

DISCUSSION.

(*Continued from Page 222.*)

Mr. Townsend Wolcott: It is interesting to notice the evolution of the dynamo—the differentiation of species, you may say. Those of us who have been in business for a number of years remember when dynamos were nearly all of one class, or, at least, there was very little difference between the different classes of dynamos. At first we had the old series machine. The first departure from that was the shunt machine, then the compound. Then we had the perfect regulation with the constant potential dynamo, then for a long time it was supposed that we could not have a constant current machine which gave perfect regulation without a regulating mechanism of some kind. Just about this particular time a machine of the opposite kind from the one we have just been hearing about is brought into public notice. That is amachine wherethe armature reaction is carried to the greatest extent for the purpose of regulation. That is the new Brush machine which has been developed by Mr. Black. In Professor Ryan's machine, which we have just been hearing about, the armature reaction is absolutely prevented. On the other hand, in the arc machine, the armature reaction is exalted, to a very great degree, for the purpose of getting the other kind of regulation. The desirability of entirely suppressing the armature reaction, perhaps, could not be questioned for a constant potential machine, if it did not require the use of extra wire, etc. Perhaps it will be used as it is, but I think a great many dynamo designers are very certain that they can use the armature reaction to advantage even in shunt machines. For instance, it has been the hobby of some dynamo designers for some time, that shunt motors can be made to work satisfactorily, and regulated by means of the armature reaction, just as well as the compound motor with the shunt in opposition to the series coil, and, as a matter of fact, there are a great many shunt and compound machines, as at present built, which are not troubled with sparking.

Mr. W. L. Bliss: The paper read by Professor Ryan this evening is certainly very interesting and of considerable value and I, for one, wish to thank him for it. I had the pleasure of being one of Professor Ryan's students at the time when he built his first machines with reactive or balancing coils, and under his direction made a number of experiments upon the same, which in all respects of operation, concur with what he has presented this evening.* In this manner I became quite familiar with the subject of armature reaction. But since I have gone out from under his care and guidance, I have been rather inclined to go astray in the matter of balancing armature reaction. It seems to me that there must be some commercial impediment that precludes a more universal adoption of the methods outlined to-night. In the first place it is either on account of the additional cost of preparing these devices and applying them to machines, or secondly, the additional output does not warrant such expenditure, or lastly, if we do use these devices we are almost certain to interfere with some one's patent. It is the object of the manufacturer to patent as many useful inventions as he can for himself and to dodge, as far as possible, those of other people. We know that these schemes for balancing armature reaction are all bound up in the Patent Office, and consequently we can hardly censure manufacturers for not having utilized them. Their failure to use them is probably not a lack of knowledge upon the subject, but on account of commercial considerations.

To take up the various points in order:—Professor Ryan says that the poles have to be made particularly heavy for this kind of construction; and as we notice from the cuts of the machines he has presented, the poles are brought very closely together. It seems to me that making the poles so exceedingly heavy adds weight and

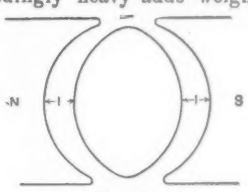


FIG. 25.

expense. Increasing the proximity of the poles must cause a considerable increase in the magnetic leakage which has to be made up by extra copper placed upon the fields and extra energy expended therein, while cutting holes through the faces of the poles seems to me to have a sort of throttling action on the field flux and reduces the useful cross-section of said poles that might otherwise be utilized to advantage. However, we are told that by filling up these holes or slots with the proper windings, and allowing the total current to circulate through them, we can overcome our armature reaction. The truth of this statement is borne out fully by experiment. We are also told that the clearance in large machines may be reduced enormously by the aid of such windings. I think, though, it is evident to nearly every one who sees large machines in operation, that a great deal of clearance is necessary, particularly in direct-coupled machinery, on account of the excessive wobbling of the armatures. This clearance is far beyond that which would be necessary if the machine could be run perfectly steady and true, without the danger of a mishap to such a complicated and somewhat delicate structure as an armature. This air-gap may be nearly or quite sufficient to cause sparkless running, so why go to farther complication? These points should all be considered in estimating the value and advisability of adopting devices for balancing armature reactance.

I have here a few notes made in reference to the output of a machine in watts per pound. Professor Ryan states that the output of a machine can be brought up to a very high figure, and that the watts per pound of material can be made as great as 20 or 30. He speaks here about a machine that was designed for two kilowatts, and weighed 400 pounds, and had a peripheral velocity of 3,000 feet. This is only five watts per pound. We built at our factory, some time ago, a motor designed to operate a launch. It was of the four-pole salient consequent type, completely ironclad, and could be placed under water with impunity. The total weight was 185 pounds, and the maximum capacity of 3.8 kilowatts, which you see was 20.3 pounds per watt. This machine operated with an armature six inches in diameter by four inches long, which you see is quite small, and yet the number of watts per pound was 20.3. This machine had a peripheral velocity of only 1,500 feet per minute and operated with a commutator of 45 sections, on which were set two brushes. The maximum current taken out of the commutator was 85 amperes, through a carbon brush about three-eighths of an inch thick, and two inches wide. The motor ran in both directions on account of the service it was placed in, and could be operated under full load one way, or full load the other way without any shifting of the brushes. There was absolutely no sparking at the brushes. The brush-holders were bolted rigidly to the casing and there was no possible chance to shift them.

To illustrate further a case in which the armature reaction was not at all injurious, I will mention that for the last year or so I have designed machinery for cart lighting purposes where the dynamo was driven by an axle connection. Here the object in view was to maintain the pressure practically constant on the lamps and on the storage batteries, at the same time utilizing a speed in the dynamo that varied from the time at which the dynamo was made operative to the time at which the train was at the maximum speed, from 600 revolutions per minute, to 1,500 revolutions per minute, the latter figure representing a velocity of the train of about 60 miles per hour. Here we used a differential coil on the field magnets, through which the main current circulated, and which demagnetized the fields of the machine as the current and speed increased. And yet with these machines, using armatures six inches in diameter, by six inches long, which is exactly the same size as given in Professor Ryan's paper, we were able to load down the machines to over two kilowatts, demagnetize the fields fully one half, and still they were sparkless, had fixed brushes and ran in both directions, which was evidently necessary on account of the service. We were able to accomplish these results without the use of balancing coils. When we first went into this extremely exacting work, we seriously contem-

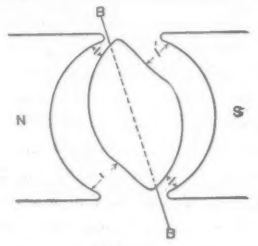


FIG. 26.

plated using some armature reactive device, but we found we did not need it. It was at this time that we looked up the patent records and secured so much valuable information on this subject.

Mr. E. A. Merrill: I would like to suggest that there are one or two points which, if covered, would make the paper a little more complete. You can take a high resistance brush and place it on the commutator in a position where the field is stronger than is required to reverse the current, yet without sparking; so if you had a dynamo which would give 115 volts with the brushes correctly placed, the brushes might be so placed as to give an effective voltage of only 110 without sparking, so that five volts is wasted; this is corrected by the balancing coil.

There are some interesting curves here. Take the curve on page 164. I think it would have been instructive if Professor Ryan had added curves showing the effect of the balancing coils with decreasing field excitation, the maximum voltage decreasing in proportion, for with this coil you can get almost down to zero volts, certainly down to five or six, with curves exactly similar to the exploration curve on page 164, but diminishing in maximum height. This method gives a full control of the voltage and the output from the maximum voltage to the minimum without distortion of the field.

Then it seems to me it is a little unfortunate that curves 11, 12, 13 and 14 follow each other as they do. Fig. 11 shows the dynamo without balancing coil and Fig. 12 the dynamo with balancing coil. It might be assumed from one following the other, that the magnetization curve in Fig. 12 was the necessary result of the use of the balancing coil. As a matter of fact, it is not the necessary result, and you would not get that curve if the balancing coil were designed to give the curve shown on page 164. The magnetization curve in Fig. 12 simply illustrates the fact that you have complete control of the distribution of magnetization in the pole-face and that you can take a pole-face with a weak pole, say at the top, and a strong pole at the bottom and reverse it; but if the same number of ampere-turns had been used in the balancing coil as in the armature, it would have given a uniform induction through the armature, and the same is true of the two curves, 13 and 14.

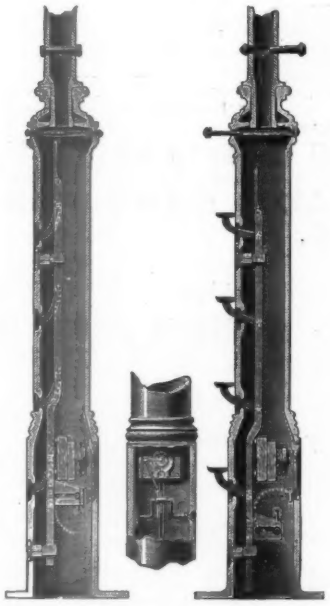
Then, if I could use the blackboard a moment, there is another method of plotting the magnetization, which makes it a little more graphic, and that is to plot the relative induction through the armature on radial lines, the depth from the pole-face to the curve representing the relative induction through the armature at all points. For example, Fig. 25 shows for every point in the pole-face very graphically the relative induction, and by plotting it for different field excitations and armature currents it shows the distortion produced by the armature current and also very plainly the effect of the balancing coil; the distance 1 from the curve to the pole-face on radial lines showing the relative induction through the armature. This figure shows the induction at no load, and is practically uniform over most of the pole-face, diminishing to zero midway between the poles. If a strong current is passed through the armature, the curve may assume the form shown in Fig. 26. The induction at 1, as you see, is very slight and in fact may be reversed under certain conditions. The induction at 1^1 is very strong, showing that these pole-tips are saturated. Now, if in addition to that, you indicate the position of the brushes and line of commutation at B, it shows graphically the strength of the field in which the commutation and reversal occurs, and it also shows on which side of the zero point it occurs, showing whether the voltage tends to be increased or diminished. Now, if curves were drawn in this way, showing the effect of the balancing coil, and also of the commutation lug, with the position of the brushes shown, you would get an excellent idea of the relative induction at every point, and of the actual effect which the balancing coil and commutation lug exert.

(*To be continued.*)

*Sibley Journal of Engineering, December, 1892; Electrical World, January 7, 1893.

A Safety Arc Lamp Standard.

The Falkirk Iron Company are manufacturing a special form of arc lamp standard which seems to possess considerable merit. It practically combines a ladder climbing arrangement with switching gear. The idea, as will be gathered from the illustration taken from our London namesake, is that at such times when the current is on the post cannot be climbed, and when the top is accessible the current is off and the lamp out. Each post has its own self-contained climbing gear—a series of foot-rests which simultaneously project or withdraw by turning a key at the base of the column. Such an arrangement obviates the necessity of carrying about a ladder from place to place, and may even dispense with the services of an assistant. The lamp trimmer carries with him a small key which renders every lamp accessible, while it is quite unclimbable by other persons. The accompanying illustrations show the patent ladder applied to the lower portion of the post, and loose foot-rests fitted in cross tubes of steel in the upper part, where they are out of reach from the ground. This plan, it is claimed, is the most economical in first cost, and it is perfectly satisfactory in operation. The controlled ladder may, however, be



SAFETY ARC LAMP STANDARD.

fitted all the way up when desired. A crank at the base, one end of which can be reached by a key through a small hole, controls a vertical rod, as shown. This rod has a series of steps jointed to it of such a form as to facilitate their motion through slots in the wall of the post. When the crank is turned half a revolution, the controlling rod is lowered and the steps project from the side sufficiently far to form a perfectly safe and easy means of climbing. As the tread closes up against the post it keeps dirt and wet from getting inside the column, where their presence would have a deleterious effect on the insulation of the electrical conductors. The draw-out pegs or foot-rests shown in the narrow part of the pillar are fitted in guide tubes so as to be quite water-tight, and at the same time to insure facile working and entire freedom from liability to jam. By the novel use of a hollow ornamental head or rosette, the steps can always be made of such a length as to give an ample foothold; even in pillars no wider than 4½ inches at the top. The switching arrangement by which the current is cut off as the steps are shot out is not shown, because it is obvious that there are many ways of accomplishing this. The makers claim that the cost of the arc lamp column is very little enhanced by such an arrangement. If such is the case, the merits of this novel lamp-post will be most carefully considered by those using arc lamp standards.

Cutting Names on Metal.

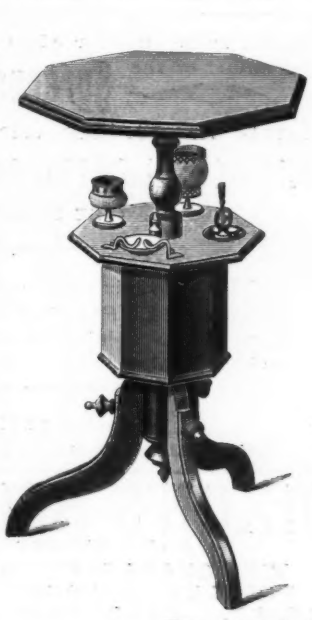
TO THE EDITOR OF ELECTRICAL REVIEW:

We notice your item in publication of April 17, headed "Who Makes This Machine?" and in reply would say that we have seen a machine of this description owned by Mr. Dan Will, and for which we furnished storage battery. The machine was used for engraving on metal and was used at the World's Fair, and we believe it was the only machine of the kind there. The last we heard of Mr. Will he was in Rochester, N. Y., where we forwarded his battery on March 27.

Yours truly,
BRADBURY-STONE ELECTRIC STORAGE COMPANY, F. J. STONE, Sec.
Lowell, Mass., April 24, 1895.

Electrical Novelty Tables.

The illustrations herewith show two tables with novel and convenient electrical appurtenances manufactured by the Adler Veneer Seat Company, 61 to 73 Milton street, Greenpoint, Brooklyn, N. Y. Fig. 1



FIGS. 1 AND 2.—ELECTRICAL NOVELTY TABLES.

shows a combination smoking and card table. It is made of oak, is 30 inches high and the top is 18 inches square. It has a revolving disk which holds cigars, ash cups, cigar cutter, and an electrical cigar lighter, while the top is unincumbered.

Fig. 2 shows a more elaborate table made of quartered oak or mahogany. The top is 22 inches square and the legs cover an area of 14 inches square. The attachments include an electric cigar lighter, electric call bell for servants, a silver-lined cigar box with musical attachment and a patent moistener, two ash cups, a cigar cutter, a tower clock, an electric light-house, thermometer, hydrometer and barometer. The batteries furnished with the outfit are of good quality and can be easily and cheaply recharged.

POLES. BEING in the heart of the chestnut timber country we can furnish chestnut poles at moderate prices. Write us.
D. S. DRAKE, Huntingdon, Pa.

PROPOSALS WANTED.

City Clerk's Office,
New Castle, Pa., April 22, 1895.

Sealed Proposals will be received until 12 o'clock noon of May 13, 1895, for 110 electric arc lights, for a term of five years.

Bids to be addressed to S. Link, Chairman Police Committee.

Specifications and Proposal Blanks can be obtained by addressing

FRANK TIDBALL,
City Clerk.

FOR SALE.

Two 40 horse-power Otto gas engines, in perfect order, having just been thoroughly overhauled at the Otto Engine Company's factory, and are at their works for shipment. For particulars, write

NEW ENGLAND ENGINEERING COMPANY,
WATERBURY, CONN.

EXPERIMENTAL WORK.

Metropolitan Chandelier AND Electric Supply Works,
HUDSON & 12th STS., HOBOKEN, N. J.
Arc Light Repairing.

WHITE-CROSBY COMPANY,
CONTRACTING ENGINEERS,
EQUITABLE BUILDING, BALTIMORE, MD.
New York Office, 29 Broadway.
Chicago Office, The Rookery.

ESTABLISHED 1867
PARTRICK & CARTER CO.
ELECTRICAL SUPPLIES
125 South 2d St. Philadelphia
CATALOGUES ON APPLICATION
Send Business Card and Mention ELECTRICAL REVIEW.

McINTIRE'S
PATENT CONNECTORS AND TERMINALS
FOR ALL ELECTRICAL PURPOSES.
THE C. McINTIRE CO.,
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BERLINER TELEPHONE.

The Berliner Telephone Company's **NEW TRANSMITTER** is the **PERFECT** instrument; works magnificently over **ANY LENGTH OF LINE.** We are anxious that you shall **TEST IT** for yourself, and are willing that you may have one (only one) **AT COST.** Finished in walnut, highly polished, size, 4x5½x6½; we will deliver, **PREPAID,** to your address for **$2.75.** We have a full line of Telephone Goods and Supplies.

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MOTHER OF PEARL

Made into any design for Electrical Trimmings, Push Buttons, Knobs, Handles, etc. Can be made to cost no more than other material.

HENRY CHARLES EULER,
513 BROADWAY, NEW YORK.

FIRE.

The destruction of our Works by fire on the 7th inst. was almost complete.
We have already resumed manufacturing and are making limited shipments, which are daily increasing.
Send us your orders. **We will fill them with reasonable despatch, or advise you promptly if we cannot.**

CROCKER-WHEELER ELECTRIC COMPANY,
Manufacturers and Electrical Engineers.
New York. Chicago. Boston. Philadelphia.
Sizes up to 250 H. P.

KINDRED INTERESTS

The Bryant Electric Company, Bridgeport, Conn., has issued a little folder illustrating some of its newest specialties, including an ingenious chandelier switch.

The Metropolitan Electric Company, Chicago, have made a new departure in establishing a bargain counter on which can be found a complete line of useful devices at hard-time prices. It will be well for the trade to inspect these goods.

Dale, Farrell & Company have recently established an office at 70 Trinity place, New York, for the construction of special electrical machinery and electrical and mechanical engineering. The company's factory at 214–218 William street will be maintained as heretofore.

The Columbia Incandescent Lamp Company, of St. Louis, has recently opened an office and store room at 620 Atlantic avenue, Boston, Mass., with Charles E. Bibber as manager, where they will carry a complete stock of high grade incandescent lamps to meet the requirements of the New England trade.

The Law Battery Company has been compelled, by increase of business, to erect a new factory at Cranford, N. J., and secure additional office facilities. Hereafter its office will be at 39 and 41 Cortlandt street, where all its business will be transacted. The battery material of the company is popularly known all over the country.

The Interior Conduit and Insulation Company, of New York, have issued a beautiful little catalogue illustrating and describing the 1895 models of Lundell fan motors for both direct and alternating currents. This company has established a large number of supply depots in the principal commercial centers and can fill orders with promptness.

"Sketches of Wonderland" is the title of a beautifully illustrated and prepared brochure issued by General Passenger Agent Chas. S. Fee, of the Northern Pacific Railroad Company. It is the company's tourist book for 1895 and contains two especially interesting chapters on the Yellowstone Park and Mount Rainier. The writer of the book is Olin D. Wheeler, who made the ascent of Mount Rainier last August especially to obtain material for the work. Every traveler will be interested in Mr. Wheeler's story and any one can have a copy of "Sketches of Wonderland" by sending six cents in stamps to Chas. S. Fee, general passenger agent Northern Pacific Railroad Company, St. Paul, Minn.

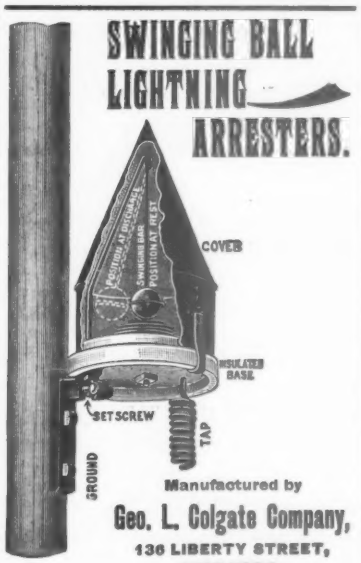
The Walker Manufacturing Company, Cleveland, Ohio, have closed the following contracts, among others, since April 1, 1895, all for speedy deliveries, which will show the popularity which their improved generators and motors are gaining. Their shops are now running both day and night:

St. Charles Street Railroad Company, New Orleans, La., three 200-kilowatt direct-coupled generators; Corning and Painted Post Street Railway Company, Corning, New York, two 125-kilowatt direct-coupled generators; Messrs. Channon & Wheeler, Quincy, Ill., one 75-kilowatt belted power generator; Manhattan Beach Hotel and Land Company, New York city, one 60-kilowatt belted lighting generator; Norfolk and Ocean View Railroad Company, Norfolk, Va., two 250-kilowatt belted generators, three double car equipments, six 50 horse-power steel motors, two double car equipments, four 30 horse-power steel motors; E. A. Darling, superintendent Columbia College, New York city, one 50-kilowatt belted lighting generator; Buffalo, Kenmore and Tonawanda Electric Railway Company, Buffalo, N. Y., two double car equipments, four 25 horse-power steel motors; Stern & Silverman, Philadelphia, Pa., for Rapid Railway Company, Detroit, Mich., two 200-kilowatt belted generators, eight double car equipments, sixteen 50 horse-power steel motors; Dunkirk and Fredonia Railroad Company, Fredonia, N. Y., one double car equipment, two 25 horse-power steel motors; Scheneley Park and Highlands Railway Company, Pittsburgh, Pa., three double car equipments, six 30 horse-power steel motors. There has also been a marked increase in their orders for general work as well as electrical work.

ELECTRO-MAGNETS
— FOR ALL —
ELECTRICAL PURPOSES.
The Varley Duplex Magnet Co.,
• 64 CORTLANDT ST., N. Y.

THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Rooms 136 and 137, 1 Broadway, NEW YORK.
Creosoted Lumber, Underground Conduits. Telegraph Poles, Piling and Ties Furnished.

SWINGING BALL LIGHTNING ARRESTERS.



Manufactured by
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